

Monitoring the effect of the ERGON IASTM technique in patients with lumbar disc herniation

YULIYAN ZLATKOV¹, KRASIMIRA ZLATKOVA²

^{1,2}Department of Kinesitherapy, Faculty of Public Health, Health Care and Sports, Southwest University "Neofit Rilski", Blagoevgrad, BULGARIA

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Abstract:

Disc herniation is a musculoskeletal disorder that is characterized by low back pain, unilateral or bilateral sciatica, motor weakness of the lower extremities and abnormalities of deep tendon reflexes. The ERGON IASTM (Instrument-assisted soft tissue mobilization) technique is an evidence-based innovative therapeutic approach that combines static and dynamic manipulations of the body's soft tissues. **Purpose.** The purpose of this study was to examine the effectiveness of the ERGON IASTM Technique in patients with lumbar disc herniation. **Methods.** This study included 36 individuals with lumbar disc herniation, who were equally divided into two groups. We applied the following evaluation methods to assess the condition of the patients: anthropometric measurements, a questionnaire, the dynamic part of the test for lumbar disc herniation of Zhelev et al., straight leg raise test and Merl d'Aubigne pain scale. **Results.** The mean age of the participants in the experimental group was 45.50 ± 9.85 years, and that in the control group was 42.81 ± 9.22 years. The mean values of the straight leg raise test measured in the first kinesitherapy procedure in the experimental group were $62.56^\circ \pm 9.52$ for the left leg and $65.50^\circ \pm 6.72$ for the right leg, and those in the control group were $57.56^\circ \pm 7.02$ (left leg) and $60.31^\circ \pm 7.38$ (right leg). After completion of therapy in both groups, the measured values in the experimental group were $73.25^\circ \pm 3.17$ (left leg) and $73.75^\circ \pm 2.84$ (right leg), and those in the control group were $66.81^\circ \pm 5.97$ (left leg) and $67^\circ \pm 5.65$ (right leg). The degree of pain on the Merl d'Aubigne scale in patients undergoing Ergon therapy was 2.19 ± 0.83 before and 0.25 ± 0.45 after. In the control group, the measured values on the Merl d'Aubigne scale were 2.75 ± 0.58 before therapy and 2.06 ± 0.57 after therapy. No statistical differences were observed with the Mann-Whitney test at $p < 0.05$. **Conclusion.** Disc herniation is associated with pain and difficulty in performing the daily and professional duties by affected people. This study demonstrated the effectiveness of the Ergon technique in patients with lumbar disc herniation. In conclusion, after two weeks of therapy with the Ergon technique, the pain symptoms were affected and the functional capabilities of affected people improved, which allowed them to return more quickly to their professional duties.

Key Words: kinesitherapy, patients, manual-manipulative techniques

Introduction

Low back pain (LBP) is a widely spread condition that affects 60–90% of adult population (Adry et al., 2016). LBP is one of the leading causes of disability in developing countries (Hoy et al., 2010; Asiri et al., 2020). According to Islam et al. (2020), LBP is a symptom, not a disease, which may occur owing to different types of abnormalities or disorders. It can be aggravated by the interrelated abnormalities between spinal muscles, nerves, bones, discs, or tendons in the lumbar spine, and it is impossible to determine a specific nociceptive cause (Islam et al., 2020). Lumbar intervertebral disc prolapse (LIVDP) is a common cause of LBP. The most frequent lumbar segments that are prone to suffer LIVDP are L4/5 followed by L5/S1. LIVDP is most common among middle-aged females (Sahrah et 2016; Ongeti et 2012; Asiri et 2020). Herniated disc is a musculoskeletal disorder that is responsible for sciatica; it occurs owing to rupture of the annulus fibrosis, following the displacement of the central mass of the intervertebral disc into the dorsal or dorso-lateral disc spaces (Barros Filho, Basile Junior, 1995; Carvalho et al., 2012). The presentation of LDH (lumbar disc herniation) may differ in each individual patient. In general, this disease is characterized by LBP, unilateral or bilateral sciatica, motor weakness of lower extremities and abnormalities of deep tendon reflexes. The symptoms and signs may be observed asymmetrically and incompletely in patients. After manipulative treatment, the back pain and sciatica increase severely and suddenly, and there is often motor weakness. These symptoms usually develop in less than 24 h (Huang, et al., 2015).

The ERGON IASTM technique is an evidence-based innovative therapeutic approach that combines static and dynamic manipulations of the body's soft tissue with special clinical equipment for the treatment of neuro-musculoskeletal pathologies. The ERGON IASTM technique is an innovative development of older approaches (IASTM technique, Graston technique, smart tools technique and tools assisted massage technique) (Fousekis, 2017).

Soft tissue techniques constitute a modern therapeutic approach for the rehabilitation of musculoskeletal disorders. All of these therapeutic procedures (ranging from classical massage, treatment of myofascial trigger points, transverse friction and active release techniques to novel myofascial release techniques with hands or IASTM tools) have been associated with an improvement in the patient's functionality mainly in terms of the peripheral joint range of motion (Fousekis et al., 2019). The use of the instrument is thought to provide a mechanical advantage for the clinician by allowing deeper penetration and more specific treatment, while also reducing imposed stress on the hands (Cheatham et al., 2016). Instrument-assisted soft tissue mobilization (IASTM) is a new technique, which has been known to be effective in reducing muscle tightness in athletes (Osailan et al., 2021). IASTM is a new tool, which allows clinicians to efficiently locate and treat individuals diagnosed with soft tissue dysfunction (Lee et al., 2016). By performing the literature search, despite the scarcity of data, we found an author who uses IASTM in patients with lumbar disc herniation. Yildirim (2020) treats iliocostalis lumborum, piriformism, gluteus medius, erector spinae, quadratus lumborum muscles, superficial and deep fascia (Yildirim, 2020). There are studies that use the ERGON IASTM technique to treat LBP, which report improvement of the volume of movement in the lumbar region. The purpose of this study was to examine the effectiveness of the ERGON IASTM technique in patients with lumbar disc herniation.

Materials and Methods

Participants:

The study was conducted at the laboratory for kinesitherapy and massage in the Eighth Academic Building of SWU "Neofit Rilski", Blagoevgrad between January, 2021 and March, 2021. This study included 36 patients with lumbar disc herniation who were 19–58 years old. The Commission on Research Ethics (KENI) at SWU "Neofit Rilski", Blagoevgrad provided ethical approval for performing this research in accordance with the Declaration of Helsinki. After getting acquainted with the nature of the study and obtaining informed consent, we proceeded to conduct the study.

Test protocol:

The following studies were performed on the patients:

- Anthropometric measurements – we measured the height, weight and BMI of each participant.
- Questionnaire survey – we included 4 questions related to the dating of pain, the performance of professional and daily duties and whether the participants experience weakness in the lower extremities.
- Assessment of pain with the modified Merl d'Aubigne scale for dynamic pain – pain when moving, according to Todorov T., 1989: Grade 0 – no pain, free movement; Grade 1 – mild, intermittent pain at the end of the movement, as well as after static fatigue; Grade 2 – pain only when moving, sometimes with a slight restriction of the movement, disappears at rest; Grade 3 – tolerable pain, provoked and intensified by movement, which moderately limits it; Grade 4 – severe pain when moving, limiting it, forcing the patient to take analgesics; Grade 5 – severe pain at the beginning of the movement, blocking it, weak effect of analgesics (Krašteva-Ruseva, 2016);
- Lumbar disc herniation test – dynamic part (V. Zhelev et al. 1996, 2004).
The dynamic part consists of 5 test movements, which provide information about the mobility of the lumbar spine. It is measured in centimetres.
Movement 1. Measurement of the depth of inclination of the body in the forward direction. S.P. standing. Lean your body forward with your arms outstretched to the floor. The distance from the floor to the middle finger is measured.
Movement 2. Schober's test. Flexion in the lumbar spine is measured. From the thorny growth of the 5th lumbar vertebra, 10 cm is measured towards the head. After bending the body forward, the length of the marked segment is measured.
Movement 3. Measurement of extension in the body from the leg. S.P. lay with his/her hands in front of his/her chest. Push the body back without lifting the upper pelvis. Measure the distance from the floor (couch) to the incision of the sternum (incisura jugularis).
Movement 4. Measurement of the depth of the left lateral inclination of the body; S.P. standing, the palms of the hands are resting on the outside of the thighs. The place of the middle finger of the hand is marked. The body leans to the left. The distance is measured from the middle finger to the floor.
Movement 5. Measurement of the depth of the right lateral inclination of the body. The measurement is analogous to the left lateral slope (Zhelev, 2011).
- Straight leg raise test – this is one of the main tests to determine disc herniation and protrusion, especially in cases of root compression (Zlatkov, Popov, 2019). The straight leg raise test is performed with the patient in a supine position. The examiner gently raises the patient's leg by flexing the hip with the knee in extension, and the test is considered positive when the patient experiences pain along the lower limb in the same distribution of the lower radicular nerve roots (usually L5 or S1) (Willhuber, Piuze, 2020).

Procedure:

The patients were equally divided into two groups according to the applied therapy. They had a confirmed disc herniation in the lumbar spine. We applied the procedures three times a week, and each session lasted for 25 min. The duration of the study period is two weeks.

For the patients from the control group, we apply manual-manipulative techniques and processing of trigger points to relax the muscles and provide pain relief. We manipulate the back, lumbar and buttock muscles.

For the participants from the experimental group, we apply manual manipulation techniques, trigger point processing and the ERGON IASTM technique. Along with the analgesia and relaxation of the back and lumbar muscles, with the application of the ERGON IASTM technique we affect the deep erector spinae muscles. We apply the ERGON IASTM technique to gluteal and hamstrings muscles. We emphasize the treatment of pelvic stabilizers – m.gluteus medius and m. gluteus minimus.

Statistical analysis:

The dynamics of the studied indicators were monitored before and after the kinesitherapy. The evaluation of research results was realized by statistical and mathematical methods and procedures using software package Graph Pad Prism 3.0. We calculated the mean and standard deviation of the studied indicators. To calculate statistically significant differences, we used the Mann–Whitney test to compare independent quantitative variables.

Results

The participants in the study were divided into two groups (experimental and control), 16 patients per group, according to the applied kinesitherapy. The experimental group consisted of 10 men and 6 women. The mean age ($\bar{X} \pm SD$) of the participants in the group was 45.50 ± 9.85 years. The mean weight ($\bar{X} \pm SD$) was 76.13 ± 8.90 , and the mean ($\bar{X} \pm SD$) height was 173.4 ± 4.4 cm. The calculated mean BMI ($\bar{X} \pm SD$) of the participants in the experimental group was 25.27 ± 2.47 .

The control group consisted of 9 men and 7 women. Their average age ($\bar{X} \pm SD$) was 42.81 ± 9.22 years. The mean values ($\bar{X} \pm SD$) of weight and height were 75.19 ± 10.25 kg and 174.8 ± 5.96 cm, respectively. The mean BMI ($\bar{X} \pm SD$) of the participants in the control group was 24.51 ± 1.95 .

The primary diagnosis of 13 patients from the experimental group indicated that they had damage in the lumbar more than at one level. A total of 8 people had disc herniation; 21 had protrusions, and 1 had sacralization. In the control group, 7 participants had disc herniation, and 14 had protrusion. Table 1 shows the distribution of pathologies in both groups according to the type and level.

Table 1. Distribution of lumbar pathologies in the study participants

Study groups	Disc herniation L5–S1	Disc herniation L4–L5	Disc protrusion L4–L5	Disc protrusion L5–S1	Disc protrusion L3–L4	Sacralization
Experimental group	6	2	11	9	1	1
Control group	5	2	5	9		

The subjects of the experimental group reported that they had arterial hypertension (4), diabetes (1), hepatitis B (1) and cervical osteochondrosis (1) as concomitant diseases. Participants in the control group had hypertension (2) and diabetes (1).

According to these risk factors, most participants in the experimental group reported prolonged sitting (15). A total of 3 participants indicated driving as a risk factor, and 1 participant indicated standing and lifting heavy weights as risk factors. In the control group, the risk factors were similar, and the distribution was as follows: prolonged sitting – 12, driving – 2, standing – 1 and lifting heavy weights – 1.

From the survey, it is clear that in the experimental group participants, the pain on average lasts for approximately 4 weeks, and in most of the participants, it lasts for years and is seasonal. The most recent pain was from 4 days ago, and the longest lasting pain was from 6 months ago. The patients reported no pain after the Ergon therapy. Prior to the treatment, all patients reported difficulty in performing their daily and work duties. A total of 11 of the participants in the experimental group reported that they had a feeling of weakness in the lower extremities, which disappeared after the therapy. In the control group, the pain dates from 3 to 6 weeks. In most of the participants, the pain is chronic and seasonal. After the treatment, the patients reported a reduction in pain. Some of them returned to their daily and work duties. Prior to the therapy, 7 of the subjects had weakness in the lower extremities, with only 1 subject reporting the disappearance of this sensation during the study period.

To assess mobility in the lumbar region, we used the dynamic part of the Zhelev et al. test for lumbar disc herniation. The results of the two study groups before and after the therapy are shown in Table 2.

Table 2. Mean values ($\bar{X} \pm SD$) from the dynamic part of the Zhelev et al. test for lumbar disc herniation in the experimental and control groups

Movement	Experimental group		Control group	
	Before therapy	After therapy	Before therapy	After therapy
Depth of the forward slope	53.19 ± 8.15	15.25 ± 7.91	52.13 ± 7.38	21.50 ± 8.88
Schober test	0.72 ± 0.45	3.34 ± 0.24	0.78 ± 0.45	2.56 ± 0.40
Extension of the body	15.81 ± 4.4	30.50 ± 5.45	19 ± 4.03	29.88 ± 5.32
Lateral slope to the left	52 ± 1.90	50.06 ± 1.34	52.50 ± 2	51.19 ± 1.78
Lateral slope to the right	52.09 ± 1.37	49.96 ± 1.28	52 ± 1.37	51.06 ± 1.29

No statistical differences were found in the Mann–Whitney test at $p < 0.05$

The mean values ($\bar{X} \pm SD$) of the straight leg raise test measured in the first kinesitherapy procedure in the experimental group were $62.56^\circ \pm 9.52$ for the left leg and $65.50^\circ \pm 6.72$ for the right leg, and those in the control group were $57.56^\circ \pm 7.02$ (left leg) and $60.31^\circ \pm 7.38$ (right leg). After the completion of therapy, in both groups, the measured mean values ($\bar{X} \pm SD$) were as follows: in the experimental group – $73.25^\circ \pm 3.17$ (left leg) and $73.75^\circ \pm 2.84$ (right leg), and in the control group – $66.81^\circ \pm 5.97$ (left leg) and $67^\circ \pm 5.65$ (right leg).

We measured the degree of dynamic pain on the Merl d'Aubigne scale in the two study groups and found the following dynamics in the values. In patients treated with the ERGON IASTM technique, the mean degree ($\bar{X} \pm SD$) of pain was 2.19 ± 0.83 before and 0.25 ± 0.45 after. In the control group, the measured mean values ($\bar{X} \pm SD$) on the Merl d'Aubigne scale were 2.75 ± 0.58 before the therapy and 2.06 ± 0.57 after the therapy.

Discussion

Currently, it is generally agreed upon that during the lifetime, most people experience LBP. This pain becomes chronic with age and relapse. This is dictated by many different factors, which are important for the development of chronic LBP, such as disc hernia, spondylolysis and degenerative disc disease (Lee, Zotti & Osti, 2016; Sairyo & Nagamachi, 2016; Botov et al, 2018).

According to Jordan et al. (1999), disc herniation is most prevalent among 30–50-year-old people, with a male to female ratio of 2:1 (Jordan et al., 1999). Disc herniation mainly occurs between the fourth and fifth decades of life (mean age of 37 years), although it has been described in all age groups. It has been estimated that 2–3% of the population may be affected, with the prevalence of 4.8% among men over 35 years of age and 2.5% among women over this age (Vialle et al., 2010). The results of the study of age and gender in our participants confirm this. The average age of the participants in our study is in the range of 30-50 years, and there are more men than women in both groups.

Height has been found to affect the occurrence of disc herniation. Men with a height of 180 cm (relative risk = 2.3) were compared with those whose height was more than 10 cm shorter. Women with a height of 170 cm or more showed a relative risk of 3.7 compared with those who were more than 10 cm shorter (Zielinska et al., 2021). We exclude height as a predisposition for the development of disc herniation because women in both groups are less than 170 cm, and in the experimental group there is 1 man over 180 cm, and 2 participants in the control group over 180 cm tall.

Although there are data in the scientific literature on the relationship between obesity and the development of herniated discs, we did not find such relationship in the participants in our study. Their body weight is normal for our country, and BMI values show overweight in the experimental group (25.27).

Slightly more than 90% of herniated discs occur at the L4–L5 or L5–S1 disc space. In a meta-analysis of 20 studies evaluating the MRI of asymptomatic individuals, the reported prevalence of disc abnormalities at any level was: 20–83% for reduction in signal intensity, 10–81% for disc bulges, 3–63% for disc protrusion (versus 0–24% for disc extrusion), 3–56% for disc narrowing and 6–56% with annular tears (Donnally, 2019). Our research confirms this. Our subjects have injuries at several levels, with the predominance of disc protrusions and hernias at levels L4–L5 or L5–S1.

Our participants reported hypertension and diabetes as comorbidities. We associate those with reduced motor activity. The connection between these diseases and the development of disc herniation has been proven in scientific studies.

According to Samartzis et al. (2017), hypertension increases the likelihood of moderate/severe disc degeneration (a phenotype highly associated with LBP) by 50%. In an age where people are becoming less physically active and more overweight/obese, the prevalence of cardiovascular risk factors will continue to increase (Samartzis et al., 2017).

Robinson et al. compared the intervertebral discs between nondiabetic and diabetic patients. They found that the proteoglycans from diabetic subjects were banded at a lower buoyant density, which indicated a lowered glycosylation rate and a lower number of sugar side chains per core protein. They concluded that these changes might lead to increased susceptibility to disc prolapse. For diabetic subjects, annulus fibrosis healing might take more time and not be as sturdy as that in nondiabetic subjects (Huang, 2016).

According to the two study groups, the most common risk factor was prolonged sitting, followed by driving and lifting heavy objects. These have been found to be the most common causes of LBP and intervertebral disc herniation. Billy et al. (2014) trace the specific relationship between LBP and prolonged sitting. According to the authors, the greatest change in disc height is at the L4–L5 level after prolonged sitting without intermittent breaks. Studies have also shown that certain occupational demands (including lifting and driving) are important risk factors for the development of LBP. The findings of this study may also suggest that prolonged sitting of as little as 4 hours may also be a factor in increasing pressure on the L4–L5 disc. These changes in pressure over a sustained time period may lead towards the disc degeneration cascade (Billy et al., 2014).

We report an improvement in the values from the dynamic part of the Zhelev et al. test for lumbar disc herniation. In patients treated with the ERGON technique, a more significant improvement in the depth of the forward slope, lateral slope, extension of the body was reported, and the Schober test reached normal values at the end of the follow-up period.

When measuring the achieved degrees according to the straight leg raise test, an improvement of the values is observed in both groups, and it is more significant in the experimental group. Ekedahl (2010) applied the straight leg raise test to patients with LBP and found that their mean values were $67.00^\circ \pm 15.00$ (left leg) and $65.00^\circ \pm 15.00$ (right leg). The same author determined that there was a difference between the degrees achieved in men and women. In men, the mean values reached were 63.00 ± 13.00 (left leg) and 61.00 ± 14.00 (right leg). In women, the mean values of the measured indicator were 72.00 ± 16.00 (left leg) and 71.00 ± 16.00 (right leg) (Ekedahl, 2010).

When measuring the degree of dynamic pain on the Merl d'Aubigne scale, it was observed that there was a significant improvement in the participants treated with the ERGON IASTM technique. In most of them, the pain was not observed after the course of treatment. In 2020, in his dissertation, Zlatkov indicated the following average values from the assessment of the degree of dynamic pain; at the beginning of the study in the experimental group: 3.13 ± 0.57 ; at the end of the study period: 0.33 ± 0.48 ; in the control group: 3.23 ± 0.57 at the beginning and 0.57 ± 0.50 at the end (Zlatkov, 2020).

Conclusion:

Disc herniation is associated with pain and difficulty in performing the daily and professional duties of those affected. There are many conservative methods to treat this condition, which states that the pain goes away in 6–12 weeks. The Ergon IASTM technique is an innovative approach that enriches kinesiotherapy practice and is successfully used in the treatment of various musculoskeletal dysfunctions. Thanks to the tools, the deep and superficial fascia of the affected muscles are effectively treated, sparing the hands of the therapists. In this study, we demonstrated the effectiveness of the Ergon technique in patients with lumbar disc herniation. After a two-week course of treatment, including 6 procedures, the condition of the patients improved. This is observed after the first procedure, by reporting an improvement in the studied indicators. The obtained results show that after two weeks of therapy with the Ergon technique in patients with lumbar disc herniation, the pain symptoms and the volume of movement are affected and the affected people return to their professional duties faster.

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