

Effectiveness of physiotherapy interventions to reduce pain in acute spinal radiculopathy

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Abstract— Radiculopathy is the name for a damage to the nerve root, which exits the spinal cord, through an opening between two adjacent vertebrae. The first symptom of this pain syndrome is the appearance of severe pain in the lumbar spine that spreads along one or both legs, and most people experience low back pain during their lifetime. In practice, various types of exercises are performed for which there is a lot of evidence that they are effective in reducing pain and improving function, especially in radiculopathy, and there is no universal system of exercises applicable to all patients, as there is no single cause of low back pain. A cohort study was conducted at the Department of Physical Medicine and Rehabilitation of the University Clinical Hospital Mostar, and outcome measures were collected at the beginning of the study, in the middle of treatment (after week 1), and at the end of the study (after week 2). All three observed interventions have the effect of reducing pain after a week of treatment, with medical massage having the best effect. The application of isometric exercises in the same period had the least effective effect, with a higher percentage of unchanged pain scores compared to the other two treatment methods. After the second week, the results show completely different results compared to the first week. Of particular interest in the measurements after the second week were the data of the group receiving interference currents, in which the average pain score was the same as in the first week, with a lower percentage of deterioration, and in the group receiving isometric exercises the average pain score after the second measurement was lower than the average grade after the first week. All these types of physiotherapy interventions work to reduce pain after five treatments, but the classic medical massage and isometric exercises retain their effect after that.

Index terms - electrotherapy, physiotherapy, low back pain, massage, radiculopathy

1 INTRODUCTION

Most people experience low back pain during their lifetime. Low back pain is defined as severe pain, muscle tension, and discomfort in the area of the body between the lower rib arch and the lower gluteal sulcus, with or without the spread of pain in the leg (Schnurrer-Luke Vrbančić, 2011). When it is characterized by local pain that does not radiate to the periphery or remains limited to the spine then it may be of vertebral origin, and may be of vertebrogenic origin when the pain is transferred to another location away from the spine (Pećina, 2004). Radiculopathy is the name for damage to the root of a nerve, which exits the spinal cord, through an opening between two adjacent vertebrae. Nerve root disorders lead to predictable segmental radicular symptoms (pain or paresthesia in the associated dermatome, muscle weakness innervated by the affected root) (Ivančević, 2010). The first symptom of this pain syndrome is the appearance of severe pain in the lumbar spine that spreads along one or both legs. With the appearance of pain, there is usually a feeling of tingling, muscle weakness, and in the most severe cases to neurological outbursts (Grazio et al., 2012; Jajić et al., 1984). Damage to the motor root can cause paresis or plegia of the feet or lower legs (if there are pathological changes in the lumbosacral region of the spine (lumboisialgia), ie shoulders and arms, if there are pathological changes in the cervical spine (cervicobrachial syndrome)), then weakened myotatic reflexes muscle atrophy (Dolbow & Throckmorton, 2021; Figueiredo, 2017). Radiculopathy can occur as a result of previous moderate back pain, but in most cases it occurs suddenly. The most common cause is changes in the intervertebral discs of the lumbar spine, which occur as a result of aging (degenerative changes) and manifest themselves in the form of hernias of the intervertebral discs of the lumbar spine. They mainly occur in the working age population from 25-55. years of age at the level of L4 - L5 and L5 - S1 (Matijejić & Grazio, 2009; Postacchini, 1996). In

the treatment of compressive radiculopathy, the degree and quality of neurological outbursts and the morphological findings of imaging techniques are analyzed. In urinary and / or stool retention disorders, the disease is treated surgically (Maduri et al., 2020). In milder cases, treatment may be conservative: in addition to resting in the pain phase, analgesics (muscle relaxants as needed) are applied, followed by physical therapy (Woods & Hilibrand, 2015). In the treatment of non-compressive radiculopathies, symptomatic drug therapy, specific therapy of basic diseases and physical therapy are used ("Radiculopathy," 2021). The forms of physical therapy used in treatment are mainly massage, electrotherapy, and kinesiotherapy (Berry et al., 2019; Childress & Becker, 2016; Stochkendahl et al., 2018). The most well-known massage technique used in medicine is classical medical massage (Swedish massage), which includes effleurage (sliding), petrissage (kneading), friction, compression, tapping (percussion), vibration and mobilization and stretching of the joints (Atchison et al., 2021; Zhong et al., 2019). Massage may be useful in treating patients with subacute and chronic low back pain, and the effects of massage are enhanced in combination with therapeutic exercises (Furlan et al., 2015). compared to other therapies it is not very financially viable but may be more acceptable due to its long-term beneficial effects (Cherkin et al., 2003). Of the electrotherapeutic methods, transcutaneous electrical nerve stimulation (TENS) is most commonly used (Kolu et al., 2018). It is also possible to apply other methods such as lasers and infrared rays, but research has not proven a significant effect (Facci et al., 2011; Kolu et al., 2018). Therapeutic exercises have been unequivocally proven effective in the prevention and treatment of patients with low back pain (Hayden et al., 2005). In practice, various types of exercises are performed for which there is a body of evidence that they are effective in reducing pain and improving function especially in radiculopathy (Cheng et al., 2015; Liang et al., 2019). There is no uni-

versal system of exercise applicable to all patients, just as there is no single cause of low back pain. In addition to selecting the appropriate exercises, it is important to perform the exercises technically correctly, which is a common mistake when the patient only receives an information booklet on exercises at home or ergonomic tips (Cheng et al., 2015; Liang et al., 2019; Matijević & Grazio, 2009). . In addition to aerobic general fitness exercises, the system of back pain exercises includes strength, endurance, stretching, range of motion, and posture and balance control exercises. Specific kinesitherapy methods for low back pain can be classified as traditional abdominal or back muscle exercises, ie flexion and extension, McKenzie exercises, specific lumbar stabilization exercises, and exercises on a kinesitherapy ball, where small amplitude movements are performed and the body adapts to instability. 2009).

2 RESPONDENTS AND METHODS

A cohort study was conducted at the Department of Physical Medicine and Rehabilitation of the University Clinical Hospital Mostar in the period from August 1, 2018 to February 1, 2019 on a sample of 120 respondents aged 25 to 45 years. Prior to the start of the study, respondents used pain medications, NSAIDs (NSAIDs) and were advised to discontinue therapy (at least 24 hours before starting new therapy) to determine the effect of the interventions as reliably as possible. Respondents were orally introduced to the method of conducting the research, and participated in the research voluntarily. They were divided into three groups and in each group there were 40 subjects of both sexes. The first group in the intervention received a classical medical massage, the second group in the intervention received analgesic electrotherapy (interference currents), and the third group had kinesitherapy (isometric exercises) in their intervention. The surveyed interventions were conducted five working days a week, for a total of two weeks lasting 40 minutes. Outcome measures were collected at the beginning of the study, in the middle of the treatment (after week 1), and at the end of the study (after week 2). The instruments used in the study were: a general questionnaire containing general data, data on life habits, data on family predisposition to lumbar pain, data on current illness (pain level, use of analgesics, use of alternative procedures) and visual analog scale of pain. The measure of the outcome in this study was a subjective assessment of pain, and was chosen because pain is the first symptom of this syndrome, which entails the appearance of other symptoms, and **we thought** that if we reduced pain we would reduce other symptoms.

2.1 Statistical analysis

The data were processed by SPSS 23 and Microsoft Excel 2010 program, and descriptive statistics methods (arithmetic mean, standard deviation, grouping, tabulation and graphical representation) were used in the processing. As for analytical methods, the Student's t-test was applied in the processing. The statistical significance was determined at the level of $p < 0.05$, and the Kruskal-Wallis test was used in the comparison of the obtained values between the groups.

3 RESULTS

Monitoring pain, which is an individual feeling, difficult to measure and objectify, is made possible by the existence of a visual-analog scale (VAS) of pain, when patients, at their discretion, rate pain intensity from 0 (no pain) to 10 (strongest possible pain). The mean score of the subjective pain score at baseline (VAS 1) in all groups was 7, with a range of scores of 6–8. According to the interpretation of the measurement scale, a score of 7 indicates the upper limit of moderate pain (Table 1).

Table 1 Results of pain self-assessment analysis

Pain	Massage			Electrotherapy			Kinesitherapy		
	M	IQR	95%CI	M	IQR	95%CI	M	IQR	95%CI
VAS1	7	1	6,63-7,12	7	2	6,74-7,21	7	2	6,65-7,15
VAS2	4	1	3,92-4,63	4	1	4,16-4,89	5	2	4,58-5,47
VAS3	3	1	2,9-3,65	4	2	4,1-4,97	3	3	2,56-3,54

* IQR-interquartile range; 95% CI- 95% confidence interval

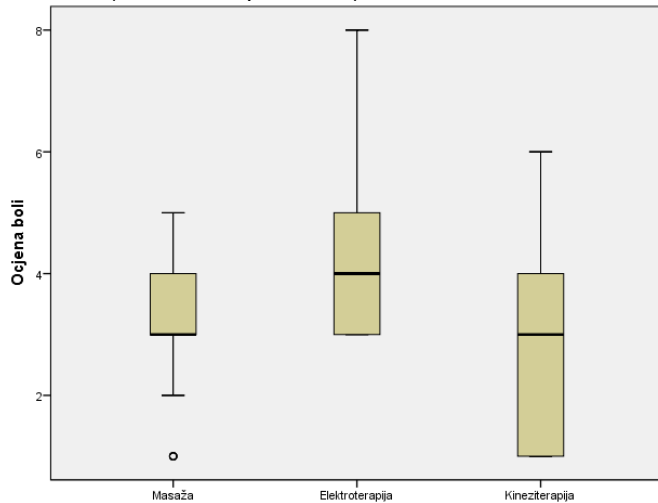
After 5 days of treatment (1 week), the pain self-assessment test was repeated (VAS 2). There was a reduction in pain in all groups, with the average pain rating in the massage group and electrotherapy group being lower than in the kinesitherapy group, which also refers to the range of grades. The mean score in the first two groups was 4, with a grade range of 3-7, while in the kinesitherapy group the grade point average was 5, with a range of grades from 2 to 8. Unchanged pain scores compared to baseline were the highest in the kinesitherapy group, where 25% of the respondents remained in the range of grades from 6 to 8, 7.5% of which had the grade of 8. The grade 8 was not recorded in the group of massages and electrotherapy after the first week. In the group of electrotherapy 15% of the respondents had the grade range from 6 to 7, and in the group of massages 10% of the respondents had that grade range. The groups did not differ in pain level at baseline (Table 2).

Table 2 Comparison of significance of average Kruskal-Wallis pain scores between groups

Pain	Massage MRank	Electro- therapy MRank	Kine- sitherapy MRank	X ₂	df	p
VAS1	58,7	63,1	59,7	0,408	2	0,815
VAS2	54,34	56,64	70,53	5,785	2	0,055
VAS3	53,59	79,09	48,83	18,61	2	0,000
9						

According to these data, medical massage and kinesitherapy are more effective in reducing pain than electrotherapy after the second week of treatment. Classical medical massage is no more effective than kinesitherapy after the second week of

treatment ($Z = -0.818$; $p = 0.413$).



Picture 1 Box-plot display of pain rating frequencies after the second week of treatment (VAS 3)

In the kinesitherapy group, there was a significant reduction in pain compared to the initial measurement and measurement after the first week (Figure 1). The average grade in the same group after the second week was 3, with a range of grades from 1 to 6.

Table 3 Comparison of pain scores within Wilcoxon pairs groups

Pain	Massage		Electrotherapy		Kinesitherapy	
	Z	p	Z	p	Z	p
VAS1-	-	0,000	-5,243	0,000	-	0,000
VAS2	5,489				5,122	
VAS1-	-	0,000	-5,104	0,000	-	0,000
VAS3	5,550				5,534	
VAS2-	-	0,000	-0,157	0,876	-	0,000
VAS3	3,531				4,411	

Table 3 shows the results of the comparison of the obtained pain scores during all measurements within each observed group. All observed interventions have a significant effect on reducing pain after one week of treatment. A more significant effect on pain reduction was found in both the massage group and the kinesitherapy group compared to the measurements after the first week and after the second week of treatment, while no significant differences were found within the electrotherapy group, which was expected given the same average scores.

4 DISCUSSION

Combining different forms of medical therapy with exercise is better than medical therapy or exercise itself. Taken from the literature over the past ten years, there is moderate to strong evidence in favor of the combination of therapy with exercise (Hidalgo et al., 2017; Paolucci et al., 2018; Toprak Celenay et al., 2021). It can be observed that Pilates, McKenzie method, Feldenkrais method are more effective than only generic, pharmacological or instrumental approach (Hidalgo et al.,

2017; Paolucci et al., 2018). This study compared the three most common physiotherapy methods used in the treatment of acute spinal radiculopathy (Berry et al., 2019; Childress & Becker, 2016; Stochkendahl et al., 2018). All three observed interventions have the effect of reducing pain after a week of treatment, more precisely a total of five treatments, with medical massage having the best effect. The application of isometric exercises in the same period had the least effective effect, with a higher percentage of unchanged pain scores compared to the other two treatment methods. After the second week or ten treatments, the results show completely different results compared to the first week. The given data of the group receiving interference currents were of particular interest in the measurements after the second week, in which the average pain score was the same as in the first week, with a lower percentage of deterioration, and in the group receiving isometric exercises the average pain score after the second measurement was 3, compared to an average score of 5 from measurements after the first week. All these types of physiotherapy interventions work to reduce pain after five treatments, but the classic medical massage and isometric exercises retain their effect after that.

5 CONCLUSION

We conclude that all the analyzed techniques have proven their effectiveness, but it is difficult to confirm the superiority of one approach over another. All observed interventions have the effect of reducing pain, with the effect of interference currents being the same after the first and second weeks of treatment. Classical medical massage is more effective than kinesitherapy after the first week of treatment, but not after the second week of treatment. Of particular interest in the measurements after the second week were the data of the group receiving interference currents, in which the average pain score was the same as in the first week, with a lower percentage of deterioration, and in the group receiving isometric exercises the average pain score after the second measurement was lower than the average grade after the first week. All these types of physiotherapy interventions work to reduce pain after five treatments, but the classic medical massage and isometric exercises retain their effect after that.

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