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The effect of the application of Kinesio Tape on pain relief in musculoskeletal disorders

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ABSTRACT

Introduction: Musculoskeletal disorders (MSDs) are common in men and women of all ages in all sociodemographic strata of society. Pain and functional limitations caused by MSDs severely limit independence and quality of life and interfere with an individual's ability to participate in family and social life and work. The aim of this study is to investigate the effects of the Kinesio Tape (KT) technique on pain intensity in patients with MSDs of the upper and/or lower extremities before, during, and after therapeutic treatment.

Methods: The study involved 123 patients of both sexes and all ages diagnosed with MSDs of the upper and/or lower extremities. Patients were randomly divided into two groups, a control group and an experimental group. The control group received the standard therapy protocol for MSDs, while the experimental group received the standard therapy protocol for MSDs plus the KT technique on the treated segment. The brief pain inventory was used to assess pain intensity. Both groups of participants were tested with the research instruments at baseline, during and after therapeutic treatment.

Results: The ability to walk due to pain was significantly less impaired in the control group than in participants in the experimental group, in whom pain significantly impeded walking ($p < 0.001$). Normal walking was significantly more impaired in the experimental group than in the control group ($p = 0.001$). Pain significantly impaired relationships with others in the experimental group compared to the control group ($p < 0.001$).

Conclusion: Subjects in the experimental group showed a significant decrease in pain in all areas after therapeutic treatment with KT compared to subjects in the control group.

Keywords: Kinesis tape; musculoskeletal disorders; pain

INTRODUCTION

Musculoskeletal disorders (MSDs), also known as musculoskeletal diseases, are a group of conditions that affect the muscles, tendons, ligaments, joints, peripheral nerves, and supporting blood vessels in the body. The term MSDs encompasses various conditions that can be acute or chronic. MSDs account for a significant proportion of diseases worldwide and have a major economic impact (1). Although the prevalence rate of MSD varies greatly depending on the body regions and the instruments used to assess symptoms, in several epidemiological studies, the reported prevalence rate was more than 30%. The main physical risk factors for the development of MSD are repetitive movements, awkward or extreme postures, fast pace of work, extreme temperatures, insufficient recovery time, mechanical pressure, and segmental vibrations or whole-body vibrations. In this regard, the main etiological mechanisms of MSD are physical and psychosocial risk factors based on the relationships between biomechanical loading and corresponding pathophysiological tissue changes, as well as changes in the neurohormonal system induced by stress (2). Globally, the prevalence of MSD is 1.3% and is most common in people aged 50–69 years (3.24%). Studies have shown that MSDs are the third leading cause of disability in men and the first leading cause in women worldwide (3). MSDs are common in men and women of all ages and in all sociodemographic strata of society. They are the most common cause of severe and persistent pain and physical disability, affecting hundreds of millions of people worldwide. They affect all aspects of life, limiting daily activities, and compromising dexterity and mobility. In Europe, one in four adults is affected (4).

Musculoskeletal pain is extremely common regardless of age, gender, or socioeconomic status, making it common even in

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younger populations, especially pain in the neck, shoulder, and back. Studies have found a high prevalence of musculoskeletal pain in the student population, ranging from 51.7% to 54.5% (5). Pain is a very common feature of most MSDs. Activities of daily living such as bathing, dressing, getting out of bed or a chair, doing chores, preparing meals, and shopping are often affected by pain, along with other common MSD symptoms such as stiffness, limited mobility, and weakened physical performance (6). Chronic pain associated with musculoskeletal problems is often the result of myofascial pain syndrome, in which pain from muscular trigger points causes pain in other parts of the body, a phenomenon commonly known as referred pain (7). Pain and functional limitations caused by MSDs significantly reduce independence and quality of life and affect the individual's ability to participate in family and social life and to engage in occupational activities (8). In MKP, it is common to undergo therapeutic treatments for pain relief. The main strategy for treating acute pain is to find, eliminate, or treat the cause of the pain in a particular area of the body. The goal is to protect injured tissue, prevent further tissue damage, and reduce the effects of disorders such as stiffness, weakness, and fatigue. Sometimes, it takes only a few days or weeks after the onset of an injury or illness, on average 6–8 weeks, and sometimes even longer (9). The implementation of effective therapeutic treatments in the treatment of MKP aims to improve the quality of life, reduce joint pain and stiffness, limit the progression of joint damage, and maintain or restore functional ability (10). The Kinesio Tape (KT) technique can be applied to a wide variety of conditions and is used in clinical practice. Despite its popularity and widespread clinical use, there is relatively little evidence to support the efficacy of the KT technique, largely due to the limited number of randomized controlled trials available. To date, evidence for the efficacy of the KT technique has relied primarily on case studies, small pilot studies, and studies with healthy participant groups (11). Several studies have shown that functional performance can be improved with the use of KT, as proper application reduces inflammation and promotes joint movement by improving blood flow and lymphatic drainage. The tension created by the tape can improve proprioception and facilitate proper posture and movement, even after the tape is removed. It also contributes to pain relief by reducing pressure on subcutaneous nociceptors and facilitating joint and muscle work by improving their sensitivity through feedback systems. The effect of KT on muscle strength and endurance is still unclear due to limited clinical and scientific evidence (12). It has been observed that KT can improve active range of motion without pain immediately after tape application in patients with shoulder pain. There is evidence that KT leads to pain relief and normalization of muscle function in the lumbar region in patients with chronic low back pain, as well as short-term pain relief in patients with shoulder pain (13). The aim of this study is to evaluate pain intensity in patients with MSDs of the upper and/or lower extremities before, during, and after therapeutic treatment.

METHODS

This study included 123 patients of both sexes and all ages from the Public Health Institution "Health Center of Sarajevo Canton," organizational unit Novi Grad – Otoka, with a diagnosis of MSDs of the upper and/or lower extremities, referred by a specialist who were referred for physical treatment. Study is approved by Ethical committee of University of Sarajevo – Faculty of health studies, and Ethical Committee of Public Health Institution "Health Center of Sarajevo Canton."

The study was conducted from May 2020 and lasted until July 2022. Patients were randomly divided into two groups, a control group and an experimental group, using stratified randomization. The control group received a standard musculoskeletal treatment protocol, while the experimental group received the standard protocol plus the KT technique applied to the treated segment. Both groups were tested with research instruments at baseline, during and after therapeutic treatment.

The study was conducted using a standard therapy protocol and the KT technique. The standard therapy protocol included the use of physical therapy and kinesitherapy techniques. Physical therapy procedures included ultrasound, magnetic therapy, IFS, TENS, manual massage, cryomassage, or hot packs, while kinesiotherapy procedures included active and active-assisted exercises, muscle strengthening exercises, and exercises with devices. The instruments used in the study were as follows: a general information questionnaire and the brief pain inventory (BPI).

The BPI-sf is one of the most commonly used instruments to assess clinical pain. It allows patients to assess the severity of their pain and the extent to which their pain interferes with various functions. Originally, the BPI-sf questionnaire was used in epidemiological studies and clinical trials of patients with cancer-related pain. Today, the BPI-sf is widely used in the assessment of pain in chronic diseases, phantom limb pain, critical limb ischemia, neuropathies, low back pain, and osteoarthritis, as well as in patients with acute post-operative pain.

The BPI-sf questionnaire is designed to include domains that provide responses to the "sensory" dimension of pain (intensity or severity) and the "reactive" dimension of pain (impairment of daily functions). The questions are worded to capture the variability of pain over time, including worst pain, least pain, average pain, and current pain. The questionnaire also includes questions about the number and type of current treatments and their perceived effectiveness, the degree to which pain affects general activity, mood, ability to walk, normal work, relationships with others, sleep, and enjoyment of life, on a 1–10 point scale (14). Because the questionnaire is licensed material, written consent was required for its use in the study. The statistical software IBM SPSS Statistics 26.00 (IBM Corporation, Armonk, New York) was used for data analysis. Categorical variables were presented with frequency as an absolute number or as a percentage per column (study group). Descriptive statistical analysis of risk was presented using the following parameters: Mean with standard deviation, for normally distributed data. For nonparametric data distributions, the median with interquartile range was used for presentation. The t-test was used to test differences in the sum of scores when the data were parametrically distributed, whereas the Kruskal–Wallis test (for three or more groups)

and the Mann–Whitney U-test (for two groups) were used for non-parametric distributions. The Friedman test was used to compare pain intensity before, during, and after treatment. Statistical significance was set at $p < 0.05$. The research results were presented textually, in tables and graphically.

RESULTS

The study included 65 female patients, who accounted for 53.28% of all participants, and 57 (46.72%) male patients. The control group consisted of 51 participants, accounting for 41.80% of all participants, while the experimental group consisted of 71 participants, accounting for 58.20% of participants. The mean age of male participants was 43.61 ± 16.66 years and that of female participants was 45.06 ± 16.71 years. No significant statistical difference was found (t = 0.478; $p = 0.633$). Regarding the use of therapeutic treatment, it was found that the mean age of participants in the control group was 43.35 ± 15.77 years and that of participants in the experimental group was 45.13 ± 17.30 years. No significant statistical difference was found (t = −0.579; $p = 0.563$) (Table 1).

Of 57 patients with MSDs of the upper extremities, 23 (40.4%) had MSDs mainly of the wrist. MSDs at the elbow joint were treated in 9 (15.8%) patients, at the shoulder joint in 23 (40.4%) patients, and at the phalanges in 2 (3.5%) patients. Both patients with MSDs at the phalanges also had wrist disorders and were treated together with other patients with wrist disorders. Of the 65 patients with MSDs of the lower extremities, 35 (53.8%) had the disease of the knee, while the ankle was treated in 28 patients (43.1%). MSDs of the hip were treated in two patients (3.1%) (Table 2).

Pain intensity, which best describes the presence of pain of the highest intensity in the 24 h before treatment, had a median value of 6.0 (4.0–8.0) in the control group, whereas in the subjects in the experimental group, the median pain intensity was 7, 0 (5.0–8.0). No statistically significant difference was found using the Mann–Whitney test (U = 1469.0; $p = 0.070$). The score describing pain intensity during the day had a median value of 6.0 (4.0–8.0) in the control group, while the median value in the experimental group was 7.0 (5.0–8.0), and no statistically significant difference was found (U = 1503.5; $p = 0.105$).

The median value describing the average pain over a long period of time was also rated as 6.0 (4.0–8.0) in the control group, while it was 7.0 (5.0–8.0) in the experimental group. No significant statistical difference was found (U = 1450.0; $p = 0.057$). Current pain intensity was rated as 6.0 (3.0–8.0) in the control group, while it was rated as 6.0 (5.0–8.0) in the experimental group, and no significant statistical difference was found (U-test = 1542.0; $p = 0.158$) (Table 3).

At the first measurement, before therapeutic treatment, subjects in the experimental group indicated that their pain significantly affected their general activities compared to subjects in the control group (U = 1223.5; $p = 0.002$). The influence of pain on the mood of the subjects in the experimental group was assessed with a median value of 7.0 (5.0–8.0), and 6.0 (2.0–7.0) for the subjects in the control group. There was a statistically significant difference compared to the studied groups (U = 1200.0; $p = 0.001$). The ability to walk due to pain was more difficult in the experimental group and was estimated to be 6.0 (3.0–8.0), statistically significantly higher than in the subjects of the control group, 2.0 (0.0–5.0) (U = 961.50; $p < 0.001$). Normal walking is statistically significantly more at risk in subjects in the experimental group compared to the control group (U = 1034.0; $p < 0.001$). Pain had a statistically significantly greater impact on relationships with others in the experimental group than in the control group (U = 879.0; $p < 0.001$). The estimated median sleep score was 7.0 (5.0–8.0) in the experimental group, which was statistically significantly higher (U = 1211.0; $p = 0.002$) than in the control group subjects, whose estimated median sleep score was 5.0 (2.0–7.0). The environment was assessed with a median value of 3.0 (0.0–7.0) in the control group and 6.0 (4.0–7.0) in the experimental group, with a statistically significant difference (U = 1134.50; $p < 0.001$) (Table 4).

The highest pain intensity in the past 24 h during the therapeutic treatment had a median value of 5.0 (4.0–6.0) in the subjects of the control group, and it was slightly higher in the subjects of the experimental group with a median of 6.0 (4.0–7.0), although the Mann–Whitney test showed no statistical significance ($p = 0.183$). The subjective assessment of pain intensity in the past 24 h was 5.0 (4.0–6.0) for subjects in the control group, lower than subjects in the experimental group, but with no statistically significant difference ($p = 0.115$). The subjects of the control group estimated the average pain intensity with a median value of 5.0 (3.0–6.0), compared to the subjects of the experimental group, whose median value was 6.0 (3.0–7.0), proving the existence of a statistically significant difference ($p = 0.047$). The median value, which assessed the intensity of the current pain, was approximately the same in the subjects of both groups, and no statistical significance was demonstrated ($p = 0.117$) (Table 5).

TABLE 1. Age distribution of respondents in relation to gender and application of therapeutic treatment

Statistical analysis	Sex		Group	
	Male	Female	Control	Experimental
Mean±SD	43.61±16.66	45.06±16.71	43.35±15.77	45.13±17.30
t	0.478		−0.579	
p	0.633		0.563	

TABLE 2. Localization of primary musculoskeletal disorders in relation to the extremities

Joint	*N*	%
Upper limb		
Wrist	23	40.4
Elbow	9	15.8
Shoulder	23	40.4
Phalanges of the fingers	2	3.5
Total	57	100
Lower limb		
Hip	2	3.1
Knee	35	53.8
Ankle	28	43.1
Total	65	100

TABLE 3. Pain intensity before therapeutic treatment (I-measurement)

Group	The greatest intensity of pain in the past 24 h	The intensity of pain in the past 24 h	The average intensity of pain	The intensity of the current pain
	Median (IQ range)	Median (IQ range)	Median (IQ range)	Median (IQ range)
Experimental	7.0 (5.0–8.0)	7.0 (5.0–8.0)	7.0 (5.0–8.0)	6.0 (5.0–8.0)
Control	6.0 (4.0–8.0)	6.0 (4.0–8.0)	6.0 (4.0–7.0)	6.0 (3.0–8.0)
Mann–Whitney test	1469	1503.5	1450.0	1542.0
p	0.070	0.105	0.057	0.158

TABLE 4. Subjective assessment of the impact of pain on daily life before therapeutic treatment

Group	General activities	Mood	Walking opportunity	Normal walking	Relationship with other people	Sleeping	Environment
	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)
Experimental	7.0 (5.0–8.0)	7.0 (5.0–8.0)	6.0 (3.0–8.0)	6.0 (3.0–8.0)	7.0 (4.0–8.0)	7.0 (5.0–8.0)	6.0 (4.0–7.0)
Control	6.0 (3.0–7.0)	6.0 (2.0–7.0)	2.0 (0.0–5.0)	2.0 (0.0–5.0)	3.0 (0.0–6.0)	5.0 (2.0–7.0)	3.0 (0.0–7.0)
Mann–Whitney test	1223.5	1200.0	961.5	1034.0	879.0	1211.0	1134.5
p	0.002	0.001	<0.001	<0.001	<0.001	0.002	<0.001

TABLE 5. Pain intensity during therapeutic treatment (II measurement)

Group	The greatest intensity of pain in the past 24 h	The intensity of pain in the past 24 h	The average intensity of pain	The intensity of the current pain
	Median (IQ range)	Median (IQ range)	Median (IQ range)	Median (IQ range)
Experimental	6.0 (4.0–7.0)	6.0 (4.0–7.0)	6.0 (3.0–7.0)	5.0 (3.0–6.0)
Control	5.0 (4.0–6.0)	5.0 (4.0–6.0)	5.0 (3.0–6.0)	4.0 (3.0–5.0)
Mann–Whitney test	1557.0	1512.0	1433.0	1511.5
p	0.183	0.115	0.047	0.117

At the second measurement, during therapeutic treatment, subjects in the experimental group reported that their pain significantly affected their general activities 6.0 (4.0–7.0) compared to subjects in the control group 5.0 (3.0–6.0), $p = 0.002$. Pain had a significantly greater effect on the mood of the subjects in the experimental group with a score of 5.0 (3.0–6.0) compared to the subjects in the control group whose score had a median of 4.0 (2.0–5.0), and a statistically significant difference was found ($p = 0.004$). Very high significance between the studied groups with $p < 0.001$ was found in the effects of pain on normal walking, relationship with other people and environment. The ability to walk due to pain was rated by the subjects in the experimental group with a median of 5.0 (2.0–7.0) and was statistically significantly higher than in the control group, which rated the same with 2.0 (0.0–4, 0). Pain also affected the sleep of subjects in both groups, with subjects in the experimental group having a median score of 5.0 (4.0–7.0) and subjects in the control group having a median score of 4.0 (2.0–5.0). A statistically significant difference was found using the Mann–Whitney test ($p = 0.006$) (Table 6).

The highest pain intensity in the past 24 h had a median value of 4.0 (3.0–6.0) in the subjects of the experimental group, while it was evaluated with a median of 4.0 (3.0–5.0) in the subjects of the control group and the existence of statistical significance was not demonstrated ($p = 0.139$). The subjects of the two studied groups had the same value for the median and interquartile range in the evaluation of pain intensity in the past 24 h, and $p = 0.169$. With Mann–Whitney test statistical significance in the evaluation of the average, pain intensity was not confirmed ($p = 0.109$). The intensity of current pain in the subjects of the experimental group was rated with a median of 4.0 (2.0–5.0) and has a higher value than the median of the subjects of the control group, which was 3.0 (2.0–4.0), without statistically significant differences ($p = 0.151$) (Table 7).

On the third measurement after the therapeutic measures, subjects in the experimental group reported that their pain significantly affected their general activities compared to subjects in the control group ($p = 0.004$). A significantly lower effect on mood was also found in subjects from the control group ($p = 0.001$). The ability to walk due to pain was significantly less impaired in the control group than in the subjects from the experimental group, in whom pain significantly impaired walking ($p < 0.001$). Normal walking was statistically significantly more impaired in subjects in the experimental group compared to the control group ($p = 0.001$). Pain impaired the relationship with other people significantly more in the experimental group than in the control group ($p < 0.001$). The rating of sleep disturbance by pain in the control group had a median score of 3.0 (2.0–4.0), as did subjects in the experimental group who had pain that disturbed sleep has a median score of 3.0 (2.0–4.0). No significant statistical difference was found ($p = 0.213$). The median score of disturbance of functioning in the environment was 2.0 (0.0–4.0) in the control group, with a significantly higher disturbance in the experimental group, with a median score of difficulty due to pain of 4.0 (2.0–5.0). A significant difference was found ($p < 0.001$) (Table 8).

Before, during, and after therapeutic treatment, pain affected the performance of the mentioned activities less and less in the subjects of the control group. The rating of the influence of pain on general activities decreased from

TABLE 6. Subjective evaluation of the effects of pain on daily activities during therapeutic treatment

Group	General activities	Mood	Walking opportunity	Normal walking	Relationship with other people	Sleeping	Environment
	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)
Experimental	6.0 (4.0–7.0)	5.0 (3.0–6.0)	5.0 (2.0–7.0)	5.0 (2.0–6.0)	5.0 (3.0–6.0)	5.0 (4.0–7.0)	4.0 (2.0–5.0)
Control	5.0 (3.0–6.0)	4.0 (2.0–5.0)	2.0 (0.0–4.0)	2.0 (0.0–4.0)	3.0 (0.0–4.0)	4.0 (2.0–5.0)	2.0 (0.0–4.0)
Mann–Whitney test	1232.0	1258.0	1025.0	1079.0	872.0	1281.5	1109.5
p	0.002	0.004	0.001	<0.001	<0.001	0.006	<0.001

TABLE 7. Pain intensity after therapeutic treatment (III measurement)

Group	The greatest intensity of pain in the past 24 h	The intensity of pain in the past 24 h	The average intensity of pain	The intensity of the current pain
	Median (IQ range)	Median (IQ range)	Median (IQ range)	Median (IQ range)
Experimental	4.0 (3.0–6.0)	4.0 (3.0–5.0)	4.0 (3.0–5.0)	4.0 (2.0–5.0)
Control	4.0 (3.0–5.0)	4.0 (3.0–5.0)	4.0 (2.0–5.0)	3.0 (2.0–4.0)
Mann–Whitney test	1530.0	1550.0	1507.0	1539.0
p	0.139	0.169	0.109	0.151

TABLE 8. Subjective evaluation of the impact of pain on daily activities after therapeutic treatment in relation to the studied groups

Group	General activities	Mood	Walking opportunity	Normal walking	Relationship with other people	Sleeping	Environment
	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)
Experimental	5.0 (3.0–6.0)	4.0 (1.0–5.0)	4.0 (1.0–5.0)	4.0 (1.0–5.0)	3.0 (2.0–4.0)	3.0 (2.0–5.0)	2.0 (1.0–4.0)
Control	3.0 (3.0–4.0)	2.0 (0.0–4.0)	1.0 (0.0–3.0)	1.0 (0.0–3.0)	2.0 (0.0–3.0)	3.0 (2.0–4.0)	1.0 (0.0–2.0)
Mann–Whitney test	1268.5	1200.5	1105.0	1188.5	1125.0	1574.5	1159.5
p	0.004	0.001	0.000	0.001	0.000	0.213	0.001

6.0 (3.0–7.0) to 3.0 (3.0–4.0), and the application of the Friedman test proved statistical significance ($p < 0.001$). The reduction of pain in the control group subjects had the greatest impact on mood, as the median score before therapeutic treatment was 6.0 (2.0–7.0) and after therapeutic treatment was 2.0 (0.0–4.0). The present pain hindered the possibility of walking and normal walking of the control group subjects the most, as the median value before therapeutic treatment was 2.0 (0.0–5.0) and after treatment was 1.0 (0.0–3.0). The application of the Friedman test proved the statistical significance of sleep disturbance in the subjects of the control group in relation to the three measurements ($p < 0.001$) (Table 9).

The subjective evaluation of the effects of pain on the activities of the subjects in the experimental group by three measurements before, during, and after therapeutic treatment is shown in Table 10. The application of the Friedman test proved that the evaluation of the impact of pain on all the mentioned activities by the three measurements was significant, with pain significantly less affecting the performance of activities after therapeutic treatment. The greatest improvement in performing activities before, during, and after therapeutic treatment, with a median difference of 4.0, was observed in sleep, relationships with others, and the environment. The effects of pain affected general activities statistically significantly less after therapeutic treatment ($p < 0.001$), with a median of 5.0 (3.0–6.0) than before therapeutic treatment 7.0 (5.0–8.0). Activities that were still significantly hindered by pain after therapeutic treatment, according to the values of the interquartile range, were walking ability, normal walking, and mood with the same value of the median and interquartile range 4.0 (1.0–5–0), but with a statistically proven difference in relation to the measurement before therapeutic treatment for all three mentioned activities ($p < 0.001$) (Table 10).

DISCUSSION

The increasing prevalence of MSDs in all age groups requires the use of evidence-based innovative therapeutic treatments in the rehabilitation of patients. In our study, we investigated the efficacy of the KT technique in a randomized clinical trial and analyzed the results of therapeutic treatment in 123 patients with MSDs in different regions of the upper and lower extremities. To prove the relevance of the obtained results, the efficacy of two therapeutic treatments in clinical practice was compared using a randomized method for the experimental and control groups, achieving an equal distribution of patients with very similar characteristics between the groups. The focus of the study was on the effectiveness of the KT technique, which was the only difference between the therapeutic treatments in both groups. Pain intensity in our study was assessed before, during, and after therapeutic treatment in four dimensions: "worst pain intensity in the past 24 h," "pain intensity in the past 24 h," "average pain intensity," and "current pain intensity." Pain intensity in the experimental group was subjectively rated in all dimensions, except current pain intensity, before therapeutic treatment with a median score of seven (7.0) with a very uniform interquartile range of 5 to 8. In contrast, subjects in the control group had a lower median score on all dimensions, six (6.0), with lower scores in the first quartile. However, there was no statistically

TABLE 9. Subjective evaluation of the effects of pain on the activities of the subjects of the control group by three measurements

Measurements	General activities	Mood	Walking opportunity	Normal walking	Relationship with other people	Sleeping	Environment
	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)
I measurement	6.0 (3.0–7.0)	6.0 (2.0–7.0)	2.0 (0.0–5.0)	2.0 (0.0–5.0)	3.0 (0.0–6.0)	5.0 (2.0–7.0)	3.0 (0.0–7.0)
II measurement	5.0 (3.0–6.0)	4.0 (2.0–5.0)	2.0 (0.0–4.0)	2.0 (0.0–4.0)	3.0 (0.0–4.0)	4.0 (2.0–5.0)	2.0 (0.0–4.0)
III measurement	3.0 (3.0–4.0)	2.0 (0.0–4.0)	1.0 (0.0–3.0)	1.0 (0.0–3.0)	2.0 (0.0–3.0)	3.0 (2.0–4.0)	1.0 (0.0–2.0)
Friedmans Test	66.476	58.188	46.173	46.686	42.109	56.438	50.206
p	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001

TABLE 10. Subjective evaluation of the effects of pain on the quality of life of the subjects in the experimental group based on three measurements

Measurements	General activities	Mood	Walking opportunity	Normal walking	Relationship with other people	Sleeping	Environment
	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)
I measurement	7.0 (5.0–8.0)	7.0 (5.0–8.0)	6.0 (3.0–8.0)	6.0 (3.0–8.0)	7.0 (4.0–8.0)	7.0 (5.0–8.0)	6.0 (4.0–7.0)
II measurement	6.0 (4.0–7.0)	5.0 (3.0–7.0)	5.0 (3.0–6.0)	5.0 (2.0–6.0)	5.0 (3.0–6.0)	5.0 (4.0–7.0)	4.0 (2.0–5.0)
III measurement	5.0 (3.0–6.0)	4.0 (1.0–5.0)	4.0 (1.0–5.0)	4.0 (1.0–5.0)	3.0 (2.0–4.0)	3.0 (2.0–5.0)	2.0 (1.0–4.0)
Friedmans Test	126.55	126.56	113.03	108.00	122.02	129.56	118.03
p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

significant difference between the groups in the subjective assessment of pain intensity. Before treatment, subjective assessment of pain was consistent. Regarding the domains of pain impairment in the subjects of the experimental group before therapeutic treatment, impairment of affect, "mood," "relationship with other people," and "sleep" were more dominant than impairment of activity. Control group participants had lower median impairment scores in all seven domains, with significantly lower median scores in activity impairment, except for "general activities." In all seven domains of pain impairment, there was a statistically significant difference compared to the tested groups. The results of our study are not consistent with the results of the MOBILIZE study, conducted in Boston on 749 people over 70 years of age, in which the presence and intensity of pain affected two domains in particular – "general activities" and "walking" (14). Iliffe et al. indicated in their study that chronic pain has a variety of effects on daily life and activities, including functional limitations, fatigue, sleep problems, and depressive mood, which significantly affect quality of life (15). The success of therapeutic treatment in reducing pain intensity was greater in the experimental group. The median of "worst pain intensity in the past 24 h," "pain intensity in the past 24 h," and "average pain intensity" had the same value of 7.0 (5.0–8.0) at the first measurement, whereas this value was significantly reduced to 4.0 (3.0–6.0) at the third measurement in all three pain dimensions. The median score of "current pain intensity" showed the least improvement, decreasing from 6.0 to 4.0, but, in this pain dimension, the interquartile range was reduced the most from 5.0–8.0 to 2.0–5.0.

Subjective ratings of the impact of pain on activities, that is, impairment in affect and impairment in activities, improved significantly in the control group after therapeutic treatment. Participants reported the greatest improvement in the area of the impact of pain on "mood," where the median score decreased from 6.0 (2.0–7.0) to 2.0 (0.0–4.0), with a statistically significant difference ($p < 0.001$). A significant improvement compared to the first measurement is also shown in the "general activities" domain, where the median score decreased by 3.0, that is, from 6.0 (3.0–7.0) to 3.0 (3.0–4.0). The smallest improvement, both in the median score and in the interquartile range, was observed in the domain's "sleep" and "relationship with other people."

Subjects in the experimental group showed significant improvement in all seven domains after therapeutic treatment compared to subjects in the control group. The improvement was greater in the areas of affect disorder than in the areas of activity disorder. "Mood," "relationship with others," and "sleep" improved significantly, with the median score dropping from 7.0 at the first measurement to 3.0 and for "mood" to 4.0. The improvement in activity disturbance after therapeutic treatment was 2.0 compared with the subjective assessment before therapeutic treatment, for the domains "general activity," "ability to walk," and "normal walking." A statistically significant difference in measurements was demonstrated in all domains. The aim of a cross-sectional study involving 766 individuals with musculoskeletal pain was to assess the ability to perform activities of daily living and to determine the association with pain and sociodemographic factors. The Nordic Musculoskeletal Complaints Questionnaire and the Numeric Pain Scale were used. The results show that the prevalence of difficulty in performing activities of daily living was 87.6% and the prevalence of musculoskeletal pain was 67.5% (16). On average, those affected were unable to perform four activities of daily living. The main reason for the inability to perform daily activities was pain, followed by age. Difficulty in performing activities of daily living was associated with lower extremity pain, which is consistent with the results of our study.

A descriptive study by Mota et al. examined the prevalence of musculoskeletal pain and its impact on activities of daily living in the Bandeira Científica Project. Four hundred and fifty-three subjects were interviewed, the mean age was 44.3 years, and 69.6% were women. The prevalence of chronic pain was 62.5%. About 67.9% of the respondents had pain almost every day. Individuals with intolerable pain intensity and daily symptom frequency had difficulty performing heavy activities (91.5%), suggesting similarity to the results of our study (17).

CONCLUSION

In the subjects of the experimental group, a significant decrease in pain in all seven areas was observed after therapeutic treatment compared to the subjects of the control group. Pain reduction was greater in the affective disorder domains ("mood," "relationship with others," and "sleep") than in the activity disorder domains ("general activities," "ability to walk," and "normal walking"). In all areas, a statistically significant difference between the studied groups was demonstrated in relation to the measurements. The effect of the applied therapeutic treatment with KT on the reduction of average pain and pain of the highest intensity was more effective on the lower than on the upper extremities. In terms of localization at the upper extremities, the greatest reduction in pain was achieved by therapeutic treatment with KT at the wrist and at the lower extremities at the knee joint.

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Authors declare no conflicts of interest.

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