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Original article

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Can selected physiotherapeutic techniques really help in treating back pain and improving the quality of life of advanced cancer patients: a randomised controlled study

[Running title: Physiotherapy in treating advanced cancer patients]

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Abstract

Background: The available literature lacks studies using the KinesioTaping (KT) method and the hold-relax (HR) technique in working with advanced cancer patients.

Patients and methods: The study involved 72 patients (38 women and 34 men), diagnosed with advanced cancer. Patients were randomly assigned either to KT group (exercise programme and KT), HR group (exercise programme and the HR technique of the proprioceptive neuromuscular facilitation — PNF method) or C group (a control group, exercise programme). To assess selected parameters the Numerical Rating Scale (NRS) scale and Edmonton Symptom Assessment System — revised (ESAS-r) were used. The physiotherapeutic programme lasted three weeks and took place 5 days a week for 30 minutes within each group. Additionally, in the KT group, kinesio tapes were applied on the paraspinal

muscles of the lumbar spine. In the HR group the therapy with the Hold–Relax technique was applied.

Results: There was a statistically significant decrease in pain in all groups and improvement in the quality of life in patients from both experimental groups. Those changes were significantly greater in the KT group than in both the C group and the HR group.

Conclusions: Both KT and HR techniques of the PNF method are effective in reducing pain and improving the quality of life in the examined advanced cancer patients, however KT has a stronger impact.

Key words: cancer, physiotherapy, pain, quality of life, kinesiology taping, PNF

Introduction

Among the main problems faced by palliative medicine is the perception of pain by patients experiencing advanced cancer. Pain is a subjective experience and is thus difficult to measure and can occur at any stage of the disease [1–3]. Improper selection of treatment and analgesic therapy in patients with terminal cancer may cause unnecessary suffering and a significant decrease in the quality of life. Reducing pain improves the patient’s mental state and their functioning in basic everyday activities, and thus contributes to the improvement of the patient’s quality of life [1, 4].

Quality of life is a multidimensional concept and one of its elements, broadly understood, is patient satisfaction with treatment even in the face of a terminal disease. Experiencing a good life in this difficult period gives the affected person the right to dignity and respect. Guidelines of the Committees of Health Ministers for the Member States of the European Union on the organisation of palliative care (12 November 2003) approved the principles of palliative care, whose main goal is to achieve and maintain the highest possible quality of life for patients [5].

Physiotherapy is among the elements of multidirectional treatment of patients in oncology and palliative medicine wards [6–10]. In line with the philosophy and idea of palliative care for patients with advanced cancer, its primary goal is to improve the quality of life for patients. This goal is attained by relieving troublesome symptoms and enabling the

patient to function at an optimal level within the limits of cancer [11–15]. Both the proprioceptive neuromuscular facilitation (PNF) method and kinesiology taping (KT) are very modern and extremely popular methods in the medical and physiotherapeutic environment. They are characterised by non-invasiveness and short duration of therapy. In the treatment and rehabilitation of palliative patients, these are very important advantages that do not burden the patient during physiotherapy. The available literature reports that these methods were effective in various patients [16–19]; however, according to the best knowledge of the authors, the available scientific literature lacks studies using both the KT method and the hold-relax (HR) technique of the PNF method in working with patients in the terminal stage of cancer. Therefore, this study aimed to assess whether these techniques can be helpful in pain therapy and in improving the functionality and quality of life of patients with advanced cancer.

Patients and methods

Patients

The study involved 72 unrelated patients of both sexes, including 38 women and 34 men, aged 50 to 75, hospitalised at the Beskidzkie Oncology Centre in Bielsko-Biała (Poland) and diagnosed with advanced cancer. The most frequently diagnosed types of cancer in the examined patients were breast cancer in women and colorectal cancer in men.

Inclusion criteria for research:

- age between 50 and 75;
- histopathology diagnosis of cancer;
- a patient in the advanced stage of the disease with any constant pain in the lumbosacral spine, resulting from metastases or primary tumours in this section;
- taking analgesics (e.g. opioids, co-analgesics) for at least a week before the examination;
- the ability to freely communicate with a physiotherapist (Mini-Mental State Examination scale score of 28 points or more)
- written consent to participate in the study.

Exclusion criteria from the study:

- age under 50 and over 75;
- disqualification from general physiotherapy;
- individual treatment with other therapeutic methods;
- change in the amount of analgesics taken (e.g. increasing the dose of the drug during the project);
- lack of contact or difficult contact with a patient (Mini-Mental State Examination score of 27 points or less);
- patients with mental disorders
- patients with primary or metastatic tumours of the central nervous system.

The project received the approval of the Bioethics Committee at the District Medical Chamber in Krakow No. 43/KBL/OIL/2017 on 14 March 2017. The study was conducted in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki 1964; revised in 2013). Informed consent was obtained from each patient. Prior to the study, all patients were randomly assigned (toss-coin method, without replacement) to three groups:

- **KT group** (n = 24) — this group of participants underwent the authors' exercise programme and KT.
- **HR group** (n = 24) — this group of participants underwent the authors' exercise programme and the HR technique of the PNF method.
- **C group** (n = 24) — a control group that underwent only the authors' exercise programme.

Table 1 presents the characteristics of the surveyed patients, categorized by groups.

Research tools

The research project was conducted using tools that are applied in scientific research on patients with advanced cancer [21, 21]. During the study, the testing time was strictly adjusted to the needs and capabilities of the examined patients.

The Numerical Rating Scale (NRS) scale: A 10-point NRS scale was used to measure pain intensity, with 0 indicating no pain and 10 the strongest possible pain intensity [22].

Edmonton Symptom Assessment System — revised (ESAS-r): this research tool is used to assess the cancer patients' quality of life. It is characterised by the high quality of the assessment of individual symptoms as well as the speed and ease of conducting the survey. This questionnaire contains ten Numerical Rating Scales consisting of two opposite poles expressed from 0 (no symptom) to 10 (the strongest symptom intensity), where values on the left side define the least intense symptom, while those on the right side point to the highest intensity of the symptom. For each symptom, the patient marks the number that is most appropriate for the occurring sensation [23].

Physiotherapy programme

The physiotherapeutic programme lasted three weeks owing to the stage of cancer in the examined patients. Physiotherapy sessions took place every day (excluding weekends) for 30 minutes and were the same for both the experimental groups and the control group. The physiotherapeutic programme was carried out in the afternoon, after lunch. The programme was conducted in accordance with the procedures in force on the Palliative Medicine Department and in individualised time intervals so as not to burden patients. During each session of the physiotherapy programme, patients were guaranteed constant medical care. A one-time physiotherapy programme was the same for each patient group and divided into three parts.

In the introductory part (approximately five minutes), before starting the exercises, the condition of each patient was assessed during a medical visit by a doctor, who was also present during and supervised the course of the entire research project, including the physiotherapy programme. This part included warm-up exercises, the main purpose of which was to prepare tissues for greater effort. These exercises included active assisted and active low-intensity exercises of the upper and lower limbs in the supine position in the patient's bed.

In the main part (approximately 20 minutes) patients practised in supine and sitting positions. The programme included active assisted, active low-intensity exercises in the patient's bed (upper and lower limbs) with ten repetitions for each joint in one series. The exercises were interspersed with breathing exercises, selected individually for the patient's

needs. In addition, patients performed active exercises with light resistance (exercises with Thera-Band) as well as stabilising reversals. This part focused on stabilising the trunk in the lower part of the spine and strengthening this section and the muscles of the lower limbs.

The final part (approximately 5 minutes) of the physiotherapeutic programme included relaxing, stretching and calming exercises.

Kinesiology taping application methodology

In the KT group, elastic bands were applied on the paraspinal muscles of the lumbar spine. They were applied every three days (there were no breaks between successive applications) by a certified therapist to maintain continuous analgesic stimulation. The tapes were applied for the first time on the first day after the questionnaire and the physiotherapy programme were carried out in the examined patients:

- An I-shaped tape was applied at 35% tension (two tapes of the same length measured from the posterior iliac spines to the height of Th12) using the assistive technique.
- The initial anchor point of the tape was applied to the S1 region (first sacral vertebra of the spine) without tension.
- The patient was in the position involving the maximum possible stretching of the paraspinal muscles and the tape was applied at 35% tension along the paraspinal muscles.
- The end anchor of the tape was applied in the region at the level of Th10–Th12 (tenth–twelfth thoracic vertebrae) without tension.
- A second tape was applied to the other side of the spine, according to the instructions above.
- A third I-shaped tape was applied perpendicularly to the previous ones, at the height of L4–L5, and a spatial correction was applied at 30% tension in the middle of the tape, while the tape anchors were applied without tension.

Hold–relax technique methodology

The therapy with the HR technique lasted about five minutes at a time and was conducted with each patient from the HR group by a certified PNF therapist (the main author of the project). The first procedure was carried out on the first day of the project at an

individualised time for each patient after completing the questionnaire and the physiotherapy programme:

- the patient lay sideways in the bed;
- the physiotherapist placed one hand on the patient's sacrum, the other hand lying freely on the patient's torso;
- the physiotherapist moved her hand in the caudal direction to stretch the muscle tissue structures;
- the patient resisted for three seconds;
- the tense muscle tissue structures were relaxed.

Statistical methods

All obtained results were analysed using Statistica software, version 13.1. Descriptive statistics concerning the studied parameters used arithmetic mean, median, minimal and maximal values, lower and upper quartiles and standard deviation. Furthermore, the results were subjected to statistical analysis. The Shapiro–Wilk test was performed to determine the normality of distribution in the tests. Both normal and abnormal distributions were observed. Measurement results were compared according to the related variables. A Student's t-Test, the Wilcoxon test and McNemara test were used. Results were considered statistically significant at $p \leq 0.05$.

Results

The first correlation to be examined was between the intensity of pain and the physiotherapeutic method used. There was a significant decrease in pain in both experimental groups and the control group; however, this change was significantly greater in the KT group than in both the control group and the other experimental group (Table 2).

The second correlation to be examined was between the change in the quality of life and the physiotherapy technique applied. A statistically significant improvement in the quality of life was noted in patients from both experimental groups, while no such relationship was observed in the control group. As was the case with pain, the applied tapes had a significantly

greater impact on improving the quality of life of those in the KT group than of those in both the HR group and the C group (Table 3).

Discussion

Attempts to examine and assess the quality of life of patients with advanced diseases often encounter obstacles that are difficult for a researcher to overcome, which is why there are only a few reports in the literature on the impact of non-pharmacological treatment methods, including physiotherapy, on the condition of palliative patients. This is a serious shortcoming because also palliative care should include a wide range of techniques, tools and methods that could help positively affect the condition of patients, particularly reduce pain and improve their quality of life.

Pain is among the main physical symptoms reported by patients in advanced cancer. Pharmacology is the basic method of pain treatment but some non-pharmacological techniques and methods can also reduce these ailments. Among the most popular physiotherapeutic methods that are currently used to fight pain, for example, is the PNF method. According to Lin et al. [24] who examined 48 patients with a frozen shoulder, PNF therapy reduced pain reported by patients. Researchers additionally combined the techniques of the PNF method with manual therapy, obtaining an even better analgesic effect and showing that the effectiveness of PNF can be increased by other physiotherapeutic methods. A similar effect of PNF on pain was observed by Maicki et al. [25] who compared the effect of this technique with manual therapy. In their study of 80 patients with degenerative changes in the cervical spine, they showed that PNF was more effective in reducing pain than manual therapy. Having conducted a systematic review and meta-analysis on the relationship between the PNF method and pain in patients with chronic low back pain, Arcanjo et al. [19] also showed that PNF is more effective in fighting pain than conventional rehabilitation. The available literature lacks reports on the effectiveness of PNF in cancer-related pain, especially in advanced cancer patients. Existing reports focus on fatigue associated with cancer in palliative care patients [26] and on oedema associated with the functioning of patients after mastectomy [27] demonstrating the effectiveness of this method in this area.

KT is another very popular non-pharmacological method of pain relief. This auxiliary method is now commonly used in working with patients with various dysfunctions, including cancer. Ortac et al. [28] examined 60 people with symptomatic thoracic outlet syndrome and

showed that the use of KT reduced pain more in patients from the experimental group than those from the control group. Similar results were obtained by Xue et al. [29] whose meta-analysis showed that KT statistically significantly reduced the pain of the lumbar spine in pregnant women. Lu et al. [16] and Sheng et al. [30] also conducted a meta-analysis of publications on the effect of KT on pain. Lu et al. [16] studied patients with degenerative changes in the knee joint, while Sheng et al. [30] examined patients with non-specific, chronic low back pain. In both cases, the authors demonstrated the high effectiveness of KT in the fight against pain reported by patients. As is the case with the PNF method, few publications examine the relationship between KT and cancer, and the existing ones focus primarily on oedema in women with breast cancer [31, 32]. Only Otero et al. [20] in their next work, in addition to the positive impact of KT on, for example, the range of motion and oedema, showed that this method was more effective in reducing pain than other physiotherapeutic methods in women with breast cancer.

Our study focused on the impact of KT and the HR technique of the PNF method on pain in advanced cancer patients. The results obtained confirm the reports from the literature that both the HR technique and KT statistically significantly reduced pain in the examined patients. In addition, in our study, the impact strength of the discussed techniques was compared with one another and in relation to the control group. It was shown that KT was the most effective method of reducing pain in patients in both the control group and the HR group.

The World Health Organization (WHO) defines the quality of life as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns [33]. Nowadays, the quality of life is considered to be one of the most important factors in evaluating the effectiveness of palliative treatment [34, 35]. The quality of life is affected by many factors and determinants, including physical ailments [36, 37] which can be effectively reduced by properly conducted physiotherapy. According to Guiu-Tula et al. [18] who conducted a systematic review and meta-analysis, PNF is an effective tool to improve the quality of life in stroke patients. A similar result was obtained by Gnus et al. [38] who examined a patient after a severe head injury with spinal epidural hematoma. The available literature lacks reports on the relationship between the PNF method and the quality of life of cancer patients. KT is another method that can improve the quality of life although reports in this case are somewhat different. According to Naci et al. [39] and Bac et al. [40] KT slightly improves the quality of

life in patients with chronic venous disease and those with rotator cuff lesions. However, Dogan et al. [41] showed that KT is an effective method to improve the quality of life in patients with primary dysmenorrhea. Similar results were obtained by Atar et al. [17] who studied patients with oedema during head and neck cancers, as well as by Tantawy et al. [42] who checked the impact of KT on the quality of life in patients with oedema after mastectomy. Our study proved that both KT and the HR technique of the PNF method were effective tools to improve the quality of life in palliative patients. Additional comparisons between the experimental groups showed that, as was the case with pain, the KT method also turned out to be statistically significantly more effective in improving the quality of life than the HR technique of the PNF method and in the examined palliative patients compared to the control group.

Conclusions

To sum up, our study allows us to take a broader look at issues related to the oncological physiotherapy of palliative care patients. The use of tapes used in the KT method and selected techniques of the PNF method show new possibilities for the practical use of taping in work with advanced cancer patients, although research in this area is still required. Our study has shown that although both KT and HR techniques of the PNF method are effective in reducing pain and improving the quality of life in the examined advanced cancer patients, KT has a statistically significantly stronger impact on the evaluated indicators.

Article information and declarations

Data availability statement

Original contributions presented in the study are included in the article and further inquiries can be directed to the corresponding author.

Author contributions

Magdalena Markowska: conceptualization, methodology, validation, investigation, resources, writing — original draft, visualization, project administration; Szymon Pasiut: conceptualization, methodology, validation, resources; Andrzej Markowski: validation, formal analysis, investigation; Katarzyna Filar-Mierzwa: resources, writing — original draft, writing — review & editing; Anna Ścisłowska-Czarnecka: formal analysis, resources, writing —

review & editing; Aneta Bac: conceptualization, methodology, validation, resources, writing - original draft, writing — review & editing, visualization, supervision, project administration.

Conflict of interest

The authors declare no conflict of interest.

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Supplementary material

None.

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Table 1. Characteristics of the surveyed patients by groups

	KT group				HR group				C group			
	x	SD	Min	Max	x	SD	Min	Max	x	SD	Min	Max
Age [years]	65.67	6.43	55.1	74.7	66.62	6.49	56.3	75	67.89	5.377	58	74.9
Between-group comparison	p = 0.4											
Body weight [kg]	70.75	11.17	53	92	68.67	12.82	49	98	68.75	14.03	48	102
Between-group comparison	p = 0.8											
Body height [cm]	166.25	7.98	150	180	168.45	7.90	155	183	165.25	10.654	150	180
Between-group comparison	p = 0.4											
BMI	25.70	4.61	19.5	40.9	23.97	3.74	17.5	29.8	25.222	4.811	17.6	35.4
Between-group comparison	p = 0.4											

x — mean, SD — standard deviation, p — level of statistical significance (t—Student test),

KT — kinesiology taping, HR — hold relax, C — control, BMI — body mass index

Table 2. Changes in the intensity of pain in the examined patients measured using the NRS

Group	NRS pre				NRS post				Pre- to post-comparison
	x	SD	Min	Max	x	SD	Min	Max	
KT	6.12	1.19	3	8	4.04	1.68	1	7	p < 0.001
HR	6.66	1.09	4	8	5.00	1.10	3	7	p < 0.001
C	6.29	0.95	5	8	5.20	0.83	4	6	p < 0.001
Between-group comparison	KT–HR p = 0.1 KT–C p = 0.6 HR–C p = 0.2				KT–HR p = 0.02* KT–C p = 0.004* HR–C p = 0.464				

x — mean, SD — standard deviation, p — level of statistical significance (Wilcoxon test,

Tukey test); * — statistically significant differences, NRS — Numerical Rating Scale

Table 3. Changes in the level of quality of life in the examined patients measured using the ESAS–r scale

Group	ESAS–r pre				ESAS–r post				Pre- to post-comparison
	X	SD	Min	Max	x	SD	Min	Max	

KT	4.25	0.79	3	5	3.04	1.23	1	5	p < 0.001*
HR	4.58	0.97	3	6	3.87	1.15	1	6	p = 0.03*
C	4.79	0.83	4	7	4.20	1.25	1	6	p = 0.06
Between-group comparison	KT-HR p = 0.2 KT-C p = 0.03* HR-C p = 0.4				KT-HR p = 0.02* KT-C p = 0.002* HR-C p = 0.3				

x — mean, SD — standard deviation, p — level of statistical significance (Wilcoxon test, Tukey test); * — statistically significant differences, ESAS—r — Edmonton Symptom Assessment System — revised