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Effectiveness of individualized physical rehabilitation programs on post-mastectomy pain in breast cancer survivors

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Abstract

Introduction. The aim of the study was to determine the effectiveness of individualized physical rehabilitation programs targeted at reducing post-mastectomy pain in breast cancer survivors.
Methods. Overall, 115 women with post-mastectomy pain were enrolled. The subjects had undergone surgical treatment and adjuvant radiation therapy for breast cancer. They were randomly assigned for the first (group A, $n = 45$), second (group B, $n = 40$), and third individualized physical rehabilitation program (group C, $n = 30$). The first program included aqua aerobics (aqua jogging, aqua building, aqua stretching), conditional swimming, and recreational aerobics; the second program included conditional swimming and Pilates exercises; the third program included yoga-based exercises and stretching. All participants received 140 sessions of rehabilitation intervention during the year and were evaluated at the beginning of the study, at 6, and at 12 months.
Results. It was observed that most of the investigated pain characteristics in all studied groups steadily improved during the year of rehabilitation. After 6 months of rehabilitation, the average value of cognitive quality of pain was statistically higher in group C compared with group A by 0.43 points ($p < 0.01$).
Conclusions. The findings suggest that the first individualized physical rehabilitation program brought about the greatest pain reduction in the affected breast and upper extremity in breast cancer survivors of the studied groups.
Key words: breast cancer, pain, women, physical rehabilitation

Introduction

The majority of women after surgical and radiation breast cancer treatment suffer from post-mastectomy pain [1–3]. Unfortunately, pain and functional disorders are common problems of these patients during the first few years after completion of treatment. Radiation treatment can produce a lot of persistent painful syndromes, especially plexopathies [4]. In addition, pain is associated with numerous negative consequences in women and may contribute to sleep disturbances, anxiety, fatigue, and depression, exerting a negative physical and psychosocial impact on patients' lives [5–9].

Many reports show that approximately 5–10% of long-term breast cancer survivors have chronic severe pain that affects the women's physical activity. Most studies have demonstrated that pain may persist for several years and considerably influences the patients' functional status and quality of life [2, 3, 6]. Some studies have reported that obesity and comorbid conditions in women are associated with a high risk of pain development after treatment [2, 10].

Physical exercises are considered as the basis for the treatment of post-mastectomy pain syndrome and they are an integral part of physical rehabilitation. Many reports have shown the effectiveness of acupuncture [11, 12], yoga exercises [13–17], Pilates-based exercises [18–20], and hydrotherapy [21] in the treatment of breast cancer-related pain and lymphedema. The results of several randomized controlled trials suggest that yoga may be a useful practice for normalization of the psycho-emotional state, as well as anxiety and depression reduction in women with post-mastectomy syndrome [13, 15].

As a consequence, it is crucial to take into account that the physical rehabilitation program should be individualized for all breast cancer survivors in accordance with their pain severity, type of surgery, and physical activity level.

The theoretical analysis of the available scientific publications suggests that the main objective of these studies was to identify the impact on several physical and psychosocial symptoms, overall fatigue, risk factors for the development of pain, rather than to assess the effectiveness of a physical rehabilitation program on post-mastectomy pain syndrome in the first 6 or 12 months following breast cancer surgery.

Therefore, the aim of our research was to determine the effectiveness of individualized physical rehabilitation programs targeted at reducing post-mastectomy pain in breast cancer survivors.

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Subjects and methods

Patients were eligible to participate if they were women aged 50–60 years who had undergone modified radical mastectomy and adjuvant radiation therapy; were able to read, write, and understand questionnaires; gave a written consent to participate; had breast cancer-related lymphedema, limitation of shoulder joint motion, and post-mastectomy pain syndrome. Treatment information was obtained from the subjects' medical records.

Women were excluded if their body mass index exceeded 25 kg/m^2 and if they had metastasis, bilateral lymphedema, and any contraindications limiting activity. After providing their written informed consent, the participants completed baseline study questionnaires.

The total of 115 women with post-mastectomy pain were enrolled in the study. The time after surgical intervention was 6.12 ± 0.27 months.

The subjects were randomly assigned to one of three groups: first individualized physical rehabilitation program (group A, $n = 45$), second individualized physical rehabilitation program (group B, $n = 40$), and third individualized physical rehabilitation program (group C, $n = 30$). The first program included water-based exercises (aqua jogging, aqua building, aqua stretching), conditional swimming, and recreational aerobics. The second program included conditional swimming and Pilates exercises. The third individualized physical rehabilitation included yoga-based exercises and stretching. All studied groups received 140 sessions of rehabilitation intervention during the year.

The individualized programs involved a reasonable choice of methods and means of physical rehabilitation that considered the course of the postoperative period, age, the patients' individual baseline pain results, the degree of lymphedema, and the presence of concomitant pathology. The developed programs were based on gradual solving of tasks, taking into account the predicted level of the functional state of the cardiovascular system and the direction factors of the rehabilitation process. The choice of the exercises respected the preliminary examination of the functional and psycho-emotional indicators, and individual goals of the patient, as well as the acceptability of the aquatic environment for exercise training of patients with post-mastectomy syndrome. According to the study hypothesis, a rational combination of land-based and aquatic exercises could lead to a significant improvement of the functional and psycho-emotional indicators and the quality of life in women with post-mastectomy syndrome. The load intensity was selected individually for each patient to obtain a specific effect on the cardiopulmonary system; it was mainly aerobic and aerobic-anaerobic load. Differentiated approach to low-impact and middle-impact aerobic exercises was applied depending on the participants' physical activity level. Exercise intensity ranged from 40% to 60% of heart rate reserve. Special equipment, like swimming boards, aqua dumb-bells, and shovels, was used to regulate the load intensity during swimming and aqua aerobics sessions.

The first individualized physical rehabilitation program included components of aqua aerobics (30%), conditional swimming (30%), and recreational aerobics (40%). The exercise intensity and session length in each individualized program depended on the level of the functional state of the cardiovascular system, which was determined by the authors' formula [22]. The developed method for determining the level of the functional state of the cardiovascular system in women with post-mastectomy syndrome included age and objectively defined parameters of central hemodynamics: heart rate, cardiac output, and left ventricle work.

The second individualized physical rehabilitation program included conditional swimming (50%) and Pilates exercises (50%), practiced 3 times a week for 1 hour. The level of women's physical condition, the number of laps, power zone, the number of repetitions, exercise intensity, and rest interval in conditional swimming were taken into consideration.

The third individualized physical rehabilitation program included yoga-based exercises (60%) and stretching (40%). Before performing asanas and breathing exercises, all women, regardless of the level of the functional state of the cardiovascular system, performed articular gymnastics, which involved preparing the body for the main load, contributing to the reduction of pain in the shoulder joint, and increasing the range of movements in all joints, particularly in the shoulder. Particular attention was given to poses that emphasized upper body strength and flexibility, while avoiding significant time with the upper extremity in a dependent position.

The evaluation of post-mastectomy pain syndrome was based on a visual analogue scale (VAS) for pain [23], and the McGill Pain Questionnaire (MPQ) [24].

VAS is a common method to obtain rapid quantitative and qualitative pain information in clinical settings. Women made a mark on a 10-cm horizontal line, which was anchored by words that described certain symptoms. The VAS score was calculated by measuring the distance from the left side of the line to the point marked by a woman.

Lack of symptoms (0 cm) was associated with the left end of the line, and the right end (10 cm) indicated serious symptoms. Intermediate points along the line represented varying degrees of symptoms. The symptom intensity of 0–1 cm pointed at almost no symptoms; the intensity of 1.0–1.9 cm represented a very slight level of symptoms; 2.0–4.0 cm meant a mild level of symptoms; 4.1–6.0 cm stood for a moderate level of symptoms; 6.1–8.0 cm represented a severe level of symptoms; and 8.1–10 cm indicated a very severe level of symptoms [23].

MPQ has been widely used to assess characteristics of pain, particularly its sensory and affective qualities. It included the following measures: the pain rating index, based on two types of numerical values that could be assigned to each word descriptor; the number of words chosen; and the present pain intensity as expressed on a 1–5 intensity scale [24].

The quality of pain was evaluated by selecting from 78 descriptors in 20 subclasses. In addition, the qualitative data consisted of 78 descriptors that characterized pain in 3 directions: sensory pain (word groups 1–10, 17–19), described in terms of temporal, pressure-related, spatial, and other properties; affective pain (word groups 11–15, 20), described in terms of tension; and cognitive pain (word groups 16, 20), described as the total estimation of pain. Also, the women pointed out the pain location in their bodies [24].

The analysis of pain characteristics was performed with the Statistica for Windows (version 8.00) software. All variables were earlier analysed for normality with the use of the Shapiro–Wilk test. Averages of data for intervals were tested for normality by the Shapiro-Wilk test and there was no reason to reject the null hypothesis because $W > W_{n;p}$, where n is the number of observations. Independent sample t-tests were applied to compare pain parameters between the women of different groups. A paired t-test of pain parameters was performed after 6 and 12 months of executing the individualized physical rehabilitation programs within group changes. The value of $p < 0.05$ was considered statistically significant.

Ethical approval

The research related to human use has been complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki, and has been approved by the authors' institutional review committee.

Informed consent

Informed consent has been obtained from all individuals included in this study.

Results

The initial MPQ results indicated that the patients predominantly used words from the sensory and evaluative subcategories rather than from the affective subcategory to describe their feelings. Most women reported dull ache, pressing, and dragging pain in the area of the postoperative scar or the upper limb; these caused a sense of fatigue, oppression, and exhaustion. Approximately 27% of the subjects reported pain feelings in the affected breast after breast cancer treatment. A detailed analysis of the participants' responses by the cognitive subcategory showed that mild pain was experienced by only 18% of the women, moderate pain by 56%, and severe pain by 30%. The results of the VAS analysis depicted the presence of mild level pain symptoms in all the studied groups of women at baseline (Figure 1).

The findings suggested that the developed individualized physical rehabilitation programs had a positive impact on reducing pain in the affected breast and upper extremity in breast cancer survivors. The annual dynamics of pain in women of group A (Table 1) depicts a gradual decrease in the indicators of sensory, affective, and cognitive subcategories. The average values for the sensory subcategory decreased by 0.69 points ($p < 0.001$) and 0.66 points ($p < 0.001$) during the first and second half of the year, respectively; the affective subcategory decreased by 0.35 points ($p < 0.01$) and 0.58 points ($p < 0.001$); the cognitive subcategory decreased by 0.71 points ($p < 0.01$) and 0.69 points ($p < 0.001$).

As for women of group B (Table 2), during the first half of the year, the average values for the sensory subcategory decreased by 0.80 points ($p < 0.001$), the affective subcategory decreased by 0.25 points ($p < 0.01$), and the cognitive

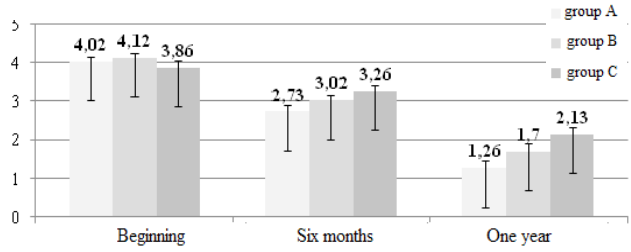

Figure 1. Pain dynamics (arithmetic mean ± error of mean) by the visual analogue scale in the women from the studied groups during rehabilitation

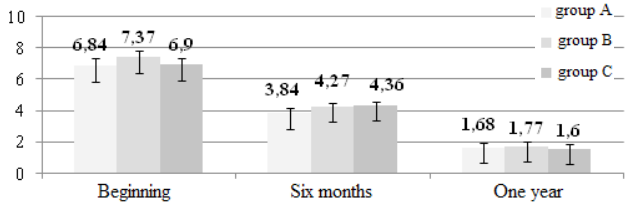

Figure 2. Dynamics of the pain rating index (arithmetic mean ± error of mean) in women from the studied groups during rehabilitation

subcategory decreased by 0.60 points ($p < 0.001$); during the second half of the year, the above-mentioned indicators decreased by 0.73 points ($p < 0.001$), 0.85 points ($p < 0.001$), 0.80 points ($p < 0.001$), respectively.

It was found that a continuous practice of yoga and stretching also helped to reduce pain in breast cancer survivors (Table 3).

Significant differences between the study groups (Figure 1) were observed in 6 months of rehabilitation with reference to the VAS value, which was lower in women of group A by 0.53 points ($p < 0.05$) compared with group C; after 1 year, the difference equalled 0.87 points ($p < 0.01$).

As presented in Figure 2, the pain rating index steadily decreased during the year in all the studied women. During the first and second half of the year, the average values of pain rating index decreased by 3.0 points ($p < 0.001$) and 2.16 points ($p < 0.001$), respectively, in group A; by 3.10 points ($p < 0.01$) and 2.55 points ($p < 0.001$) in group B; and by 2.54 points ($p < 0.01$) and 2.76 points ($p < 0.001$) in group C.

Table 1. The evolution of pain characteristics by the McGill Pain Questionnaire (arithmetic mean ± error of mean) in patients of group A during rehabilitation

Pain quality indicator	Group A (n = 45)		
	Baseline	Six months	One year
Sensory quality	1.86 ± 0.13	1.17 ± 0.09**	0.51 ± 0.09***
Affective quality	1.35 ± 0.13	1.00 ± 0.09*	0.42 ± 0.08***
Cognitive quality	2.11 ± 0.11	1.40 ± 0.11**	0.71 ± 0.11***

* $p < 0.01$, ** $p < 0.001$ compared with the initial data; *** $p < 0.001$ compared with the data for 6 months

Table 2. The evolution of pain characteristics by the McGill Pain Questionnaire (arithmetic mean ± error of mean) in patients of group B during rehabilitation

Pain quality indicator	Group B (n = 40)		
	Baseline	Six months	One year
Sensory quality	2.05 ± 0.11	1.25 ± 0.11**	0.52 ± 0.11***
Affective quality	1.37 ± 0.09	1.12 ± 0.07*	0.27 ± 0.07***
Cognitive quality	2.25 ± 0.10	1.65 ± 0.10**	0.85 ± 0.10***

* $p < 0.01$, ** $p < 0.001$ compared with the initial data; *** $p < 0.001$ compared with the data for 6 months

Table 3. The evolution of pain characteristics by the McGill Pain Questionnaire (arithmetic mean ± error of mean) in patients of group C during rehabilitation

Pain quality indicator	Group C (n = 45)		
	Baseline	Six months	One year
Sensory quality	2.16 ± 0.13	1.10 ± 0.14*	0.20 ± 0.08**
Affective quality	1.23 ± 0.10	1.26 ± 0.08	0.30 ± 0.08**
Cognitive quality	2.30 ± 0.08	1.83 ± 0.06*	1.00 ± 0.08**

* $p < 0.001$ compared with the initial data, ** $p < 0.001$ compared with the data for 6 months

Table 4. Comparison of pain characteristics by the McGill Pain Questionnaire (arithmetic mean ± error of mean) between the patients of study groups during rehabilitation

Pain quality indicator	Six months			One year		
	Group A (n = 45)	Group B (n = 40)	Group C (n = 30)	Group A (n = 45)	Group B (n = 40)	Group C (n = 30)
Sensory quality	1.17 ± 0.09	1.25 ± 0.11	1.10 ± 0.14	0.51 ± 0.09	0.52 ± 0.11*	0.20 ± 0.08**
Affective quality	1.00 ± 0.09	1.12 ± 0.07	1.26 ± 0.08	0.42 ± 0.08	0.27 ± 0.07	0.30 ± 0.08
Cognitive quality	1.40 ± 0.11	1.65 ± 0.10	1.83 ± 0.06***	0.71 ± 0.11	0.85 ± 0.10	1.00 ± 0.08**

* $p < 0.05$ compared with the data between group B and group C, ** $p < 0.05$, *** $p < 0.01$ compared with the data between group A and group C

After 6 months of rehabilitation, the value of pain rating index in group A was statistically significantly lower by 0.43 points ($p < 0.05$) and by 0.52 points ($p < 0.05$) compared with group B and group C, respectively. The comparison of pain rating index between the patients of the studied groups did not show any significant differences at the end of rehabilitation.

The comparison of pain characteristics by MPQ between the participant during rehabilitation is presented in Table 4. The results of pain characteristics in half a year proved that the cognitive quality of pain was statistically higher in group C than in group A by 0.43 points ($p < 0.01$). After 12 months of rehabilitation, the tendency of the prevalence of this indicator for group C was preserved.

Discussion

Pain is one of the most often reported symptoms and treatment-related side effects that affect a lot of breast cancer survivors [2, 3, 5, 10]. It can be observed long time after treatment completion and significantly impact on the patients' quality of life [2, 6, 25].

Most of the modern studies demonstrate an essential role of pain in the onset of depression, fatigue, and poor quality of life among breast cancer survivors. The importance of the problem is underlined by the existence of numerous integrative therapies [26, 27] and comprehensive coping strategies [28] to manage treatment-related side effects in this group of patients. Numerous reviews show the effectiveness of physical exercises in reducing breast cancer treatment-related pain complications and improving the life quality of women [7, 10, 13, 15]. Despite the achieved progress in the treatment of breast cancer-related pain, the problem of these patients' physical rehabilitation remains relevant.

In contrast to previous studies [8, 11, 16, 18], our investigation applied low-impact and middle-impact individual water-based (aqua aerobics, conditional swimming) and land-based (recreational aerobics, Pilates, yoga) exercises that depended on each participant's health status. Such a rational combination of exercises contributed to a significant pain reduction throughout the year of rehabilitation. The strengths of our study were that the individualization of load intensity depended on the functional state of the cardiovascular system, which was determined by the authors' formula, allowing to objectively assess the cardiovascular system function among breast cancer survivors and plan a rehabilitation program. There was a decrease in the pain intensity evaluation on MPQ and VAS in the women of all studied groups.

Taken together, findings from our research show a significant role of individually developed programs of physical rehabilitation in reducing pain among breast cancer survivors.

Future research should be aimed at determining the effectiveness of the individualized physical rehabilitation programs in improving the quality of life in women with post-mastectomy syndrome.

Limitations

The results of the current study have some limitations. The generalizability of our findings might be affected by the study population involved in the research and by pain assessment with the questionnaire. Moreover, the different socioeconomic status and genetic factors of the patients could have influenced the obtained results.

Conclusions

The findings suggested that the individually developed physical rehabilitation programs had a positive impact on reducing pain in the affected breast and upper extremity among breast cancer survivors. The first individualized physical rehabilitation program turned out the most effective in pain reduction, as indicated by VAS and pain rating index after 6 months of rehabilitation.

Disclosure statement

No author has any financial interest or received any financial benefit from this research.

Conflict of interest

The authors state no conflict of interest.

References

1. Forsythe L, Alfano CM, George SM, McTiernan A, Baumgartner KB, Bernstein L, et al. Pain in long-term breast cancer survivors: the role of body mass index, physical activity, and sedentary behavior. Breast Cancer Res Treat. 2013;137(2):617–630; doi: 10.1007/s10549-012-2335-7.
2. Gärtner R, Jensen MB, Nielsen J, Ewertz M, Kroman N, Kehlet H. Prevalence of and factors associated with persistent pain following breast cancer surgery. JAMA. 2009;302(18):1985–1992; doi: 10.1001/jama.2009.1568.
3. Lee E, Takita C, Wright JL, Reis IM, Zhao W, Nelson OL, et al. Characterization of risk factors for adjuvant radiotherapy-associated pain in a tri-racial/ethnic breast cancer population. Pain. 2016;157(5):1122–1131; doi: 10.1097/j.pain.0000000000000489.
4. Dropcho EJ. Neurotoxicity of radiation therapy. Neurol Clin. 2010;28(1):217–234; doi: 10.1016/j.ncl.2009.09.008.
5. Stubblefield MD, Keole N. Upper body pain and functional disorders in patients with breast cancer. PMR. 2014; 6(2):170–183; doi: 10.1016/j.pmrj.2013.08.605.
6. Satija A, Ahmed SM, Gupta R, Ahmed A, Rana SP, Singh SP, et al. Breast cancer pain management – a review of current & novel therapies. Indian J Med Res. 2014;139(2):216–225.
7. Amatya B, Khan F, Galea MP. Optimizing post-acute care in breast cancer survivors: a rehabilitation perspective. J Multidiscip Healthc. 2017;10:347–357; doi: 10.2147/JMDH.S117362.
8. Chandwani KD, Perkins G, Nagendra HR, Raghuram NV, Spelman A, Nagarathna R, et al. Randomized, controlled trial of yoga in women with breast cancer undergoing radiotherapy. J Clin Oncol. 2014;32(10):1058–1065; doi: 10.1200/JCO.2012.48.2752.
9. Cramer H, Lange S, Klose P, Paul A, Dobos G. Can yoga improve fatigue in breast cancer patients? A systematic review. Acta Oncol. 2012;51(4):559–560; doi: 10.3109/0284186X.2011.637960.
10. Ribeiro Pereira AC, Koifman RJ, Bergmann A. Incidence and risk factors of lymphedema after breast cancer treatment: 10 years of follow-up. Breast. 2017;36:67–73; doi: 10.1016/j.breast.2017.09.006.
11. Zhu H, Li J, Peng Z, Huang Y, Lv X, Song L, et al. Effectiveness of acupuncture for breast cancer related lymphedema: protocol for a single-blind, sham-controlled, randomized, multicenter trial. BMC Complement Altern Med. 2017;17(1):467; doi: 10.1186/s12906-017-1980-0.
12. Genç F, Tan M. The effect of acupressure application on chemotherapy-induced nausea, vomiting, and anxiety in patients with breast cancer. Palliat Support Care. 2015; 13(2):275–284; doi: 10.1017/S1478951514000248.
13. Bower JE, Garet D, Sternlieb B, Ganz PA, Irwin MR, Olmstead R, et al. Yoga for persistent fatigue in breast cancer survivors: a randomized controlled trial. Cancer. 2012;118(15):3766–3775; doi: 10.1002/cncr.26702. Available from: http://onlinelibrary.wiley.com/doi/10.1002/cncr.26702/abstract.
14. Culos-Reed SN, Carlson LE, Daroux LM, Hately-Aldous S. A pilot study of yoga for breast cancer survivors: physical and psychological benefits. Psychooncology. 2006;15(10):891–897; doi: 10.1002/pon.1021.
15. Harder H, Parlour L, Jenkins V. Randomised controlled trials of yoga interventions for women with breast cancer: a systematic literature review. Support Care Cancer. 2012; 20(12):3055–3064; doi: 10.1007/s00520-012-1611-8.
16. Loudon A, Barnett T, Williams A. Yoga, breast cancer-related lymphoedema and well-being: a descriptive report of women's participation in a clinical trial. J Clin Nurs. 2017;26(23–24):4685–4695; doi: 10.1111/jocn.13819.
17. Yagli NV, Ulger O. The effects of yoga on the quality of life and depression in elderly breast cancer patients. Complement Ther Clin Pract. 2015;21(1):7–10; doi: 10.1016/j.ctcp.2015.01.002.
18. Eyigor S, Karapolat H, Yesil H, Uslu R, Durmaz B. Effects of pilates exercises on functional capacity, flexibility, fatigue, depression and quality of life in female breast cancer patients: a randomized controlled study. Eur J Phys Rehabil Med. 2010;46(4):481–487.
19. Şener HÖ, Malkoç M, Ergin G, Karadibak D, Yavuzşen T. Effects of clinical Pilates exercises on patients developing lymphedema after breast cancer treatment: a randomized clinical trial. J Breast Health. 2017;13(1):16–22; doi: 10.5152/tjbh.2016.3136.
20. Stan DL, Rausch SM, Sundt K, Cheville AL, Youdas JW, Krause DA, et al. Pilates for breast cancer survivors. Clin J Oncol Nurs. 2012;16(2):131–141; doi: 10.1188/12.CJON.131-141.
21. Cantarero-Villanueva I, Fernández-Lao C, Cuesta-Vargas AI, Del Moral-Avila R, Fernández-de-Las-Peñas C, Arroyo-Morales M. The effectiveness of a deep water aquatic exercise program in cancer-related fatigue in breast cancer survivors: a randomized controlled trial. Arch Phys Med Rehabil. 2013;94(2):221–230; doi: 10.1016/j.apmr.2012.09.008.
22. Briskin Y, Odynets T. Prediction algorithm of the functional state of women with post-mastectomy syndrome [in Ukrainian]. Slobozhans'kii naukovo-sportyvnyi visnyk. 2016;4(54):22–25.
23. Hauser K, Walsh D. Visual analogue scales and assessment of quality of life in cancer. J Support Oncol. 2008; 6(6):277–282.
24. Ngamkham S, Vincent C, Finnegan L, Holden JE, Wang ZJ, Wilkie DJ. The McGill Pain Questionnaire as a multidimensional measure in people with cancer: an integrative review. Pain Manag Nurs. 2012;13(1):27–51; doi: 10.1016/j.pmn.2010.12.003.
25. Odynets T, Briskin Y, Sydorko O. Psycho-emotional state and quality of life characteristics in women with post-mastectomy syndrome with different types of attitude to the disease. Physiotherapy Quar. 2018;26(1):9–12; doi: 10.5114/pq.2018.74706.
26. Greenlee H, DuPont-Reyes MJ, Balneaves LG, Carlson LE, Cohen MR, Deng G, et al. Clinical practice guidelines on the evidence-based use of integrative therapies during and after breast cancer treatment. CA Cancer J Clin. 2017;67(3):194–232; doi: 10.3322/caac.21397.
27. Robb KA, Newham DJ, Williams JE. Transcutaneous electrical nerve stimulation vs. transcutaneous spinal electroanalgesia for chronic pain associated with breast cancer treatments. J Pain Symptom Manage. 2007;33(4):410–419; doi: 10.1016/j.jpainsymman.2006.09.020.
28. Gaston-Johansson F, Fall-Dickson JM, Nanda J, Ohly KV, Stillman S, Krumm S, et al. The effectiveness of the comprehensive coping strategy program on clinical outcomes in breast cancer autologous bone marrow transplantation. Cancer Nurs. 2000;23(4):277–285; doi: 10.1097/00002820-200008000-00004.