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The role of physical activity in supporting treatment of coxarthrosis symptoms in elderly patients

Malgorzata Kawa
Faculty of Kinesiotherapy and Rehabilitation, Gdansk University of Physical Education and Sport in Gdansk, Poland, malgorzata.kawa@awf.gda.pl

Malgorzata Kowza-Dzwonkowska
Faculty of Tourism and Recreation, Gdansk University of Physical Education and Sport in Gdansk, Poland

Agnieszka Schenk
Faculty of Kinesiotherapy and Rehabilitation, Gdansk University of Physical Education and Sport in Gdansk, Poland

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ORIGINAL

The role of physical activity in supporting treatment of coxarthrosis symptoms in elderly patients

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A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

Małgorzata Kawa[1 ACDEF], **Małgorzata Kowza-Dzwonkowska**[2 CDEF],

Agnieszka Schenk[1 BCDEF]

[1] Faculty of Kinesiotherapy and Rehabilitation, Gdansk University of Physical Education and Sport in Gdansk, Poland

[2] Faculty of Tourism and Recreation, Gdansk University of Physical Education and Sport in Gdansk, Poland

abstract

Background Next to degenerative changes of the spine, osteoarthritis of the hip is one of the most common diseases of the musculoskeletal system in people after the age of 65. The purpose of this study is to compare and evaluate the analgesic effectiveness treatments with exercises on a bicycle ergometer in osteoarthritis of the hip in patients.

Material/Methods The study involved 30 persons with degenerative disease of the hip referred to 10-day rehabilitation with a weekend break. In Group A 14 patients were subjected to treatments with local cryotherapy and laser therapy; in Group B 16 this treatment together exercises on a bicycle ergometer. The scale of pain Visual Analogue Scale and the Laitinen scale were used in the study.

Results In both groups there was a statistically significant reduction in symptoms related to degenerative disease. In Group B it was improvement in the form of a reduction in pain higher by 6%, the frequency of pain by 9%, the use of painkillers by 18% and in limitation of physical activity by 8% compared to patients from Group A.

Conclusions Combining physical therapy treatments with movement turned out to be a more effective therapy.

Key words Degenerative diseases, physiotherapy, pain, gerontology

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Corresponding author: Małgorzata Kowza-Dzwonkowska; Department of Health Promotion, Faculty of Tourism and Recreation, Gdansk University of Physical Education and Sport in Gdansk; Górskiego 1 St. 80-336 Gdańsk, Poland; e-mail: mkd@awf.gda.pl

INTRODUCTION

The process of aging is accompanied by a loss of muscle mass (sarcopenia), which is aggravated by a lack of physical activity and by co-existing diseases [1]. This results in a loss of muscle strength, impaired balance and gait instability [2, 3, 4]. Physical activity undertaken by the elderly reduces the risk of incidence of cardiovascular diseases, the nervous system diseases, joint diseases, diabetes, osteoporosis, and obesity; it also affects a reduction in depressive states and improves the quality of life. Research has confirmed a correlation between physical activity and the quality of life of elderly persons [5, 6, 7, 8]. Before starting a training program, each elderly patient should be subjected to the total geriatric examination. Qualifying tests must be carried out and one should participate in control checks [9]. Systematic diagnosis is a prerequisite for a safe and efficient conduct of a physical activity programme [10].

Osteoarthritis is often disclosed after the age of 60 years. Its development is significantly influenced by predisposing factors, such as late age, ethnic factors, birth factors, abnormal joint mechanics, overweight, performed occupation, physical activity, high bone mass, or hormone levels. Often there is premature wear and degeneration of the tissues making up the hip joint. These changes may affect one or both hip joints at the same time [7, 11]. This is frequently associated with pain, disability and reduced quality of life [12]. Due to the frequency of incidence, this is a serious social, health and economic problem.

Treatment of hip osteoarthritis is dependent on the severity of the disease and its form (acute or chronic condition). Both pharmacological and drug-free treatment (kinesiotherapy, physical therapy, manual therapy and massage) as well as surgery are applied. The most important part of improving treatment is active kinesiotherapy assisted by physical therapy. The procedures aim at muscle relaxation, vasodilation as well as the analgesic and anti-inflammatory effect.

Laser therapy is a commonly used physical therapy treatment in coxarthrosis. The absorbed laser light initiates a series of photochemical reactions, resulting, among others, in increased permeability of cell membranes thus accelerating the process of restitution of the tissues, reducing inflammation, and eliminating effusion. The laser has a positive effect on the degree of tissue oxygenation, the process of healing wounds, fractures, regeneration of the cartilage tissue and it affects the nervous system. Amplifying light by stimulating radiation eliminates or reduces ailments in pain syndromes of the spine, osteoarthritis, entesopathies and neuralgias [13]. The biological effect that occurs under the influence of laser radiation depends on the used power (changes at the cellular level). In treatment small and medium power doses are used, which cause a thermal effect raising the tissue temperature by 0.1–0.5°C [14]. In treatment of pain ailments in hip osteoarthritis also other physical therapy treatments are applied. Therapy with cold lowers the temperature of the tissues in order to start reactions beneficial to health (biochemical, hormonal and clinical changes). The effect of low temperature on the body depends on: the time of exposure to cold, the temperature, the amount of heat and the speed with which the heat is eliminated from the body [15]. Cold affects the body in two phases. In the first one, there is a loss of heat and lowering of the temperature despite defensive reactions of the organism against heat loss. There is contraction of blood vessels, a reduction in the blood flow, a decrease

in tissue metabolism and fluid dynamics, an increase in the pain threshold, an increase in adrenal activity and in venous and arterial blood pressure, and slowing down of nerve conduction. In the second phase, a reduction in tone and vasodilation take place. Under the influence of the above responses to local cryotherapy, an analgesic, anti-inflammatory, and anti-oedematous effect is achieved; there is relaxation of skeletal muscles, an improvement in their strength, and an increase in the range of motion of the treated joints [16]. The effects of local cryotherapy persist for 2-4 hours. This is a time for intense kinesiotherapy [17, 18].

The aim of the study is to evaluate the analgesic effect of local cryotherapy and laser therapy treatments in combination with exercises on a bicycle ergometer in the treatment of hip joint degeneration in patients aged over 65 years in comparison with the above procedures applied without physical activity.

MATERIAL AND METHODS

TESTED PERSONS

Patients with degenerative changes of the hip who contacted a specialist doctor and were referred to physiotherapeutic treatments voluntarily participated in the study. The physiotherapy treatments included 30 persons in total. In Group A, there were 14 persons aged 65 to 84 years. The mean age for the group was 75.21 ±6.51 years old. The duration of the disease on average amounted to 7.14 ±5.31 years. In Group B, there were 16 persons aged 66 to 84 years. The mean age for the group was 71.5 ±5.73 years. The disease duration on average was 6.01 ±6.06 years. The subjects' characteristics are presented in Table 1.

Tabele 1. Characteristics of subjects

Subjects		N	Mean	Minimum	Maximum	SD
A	Patient's age	14	75.21	65	84	6.52
B	Patient's age	16	71.50	65	84	5.74
A	Body weight (kg)	14	75.79	62	94	10.24
B	Body weight (kg)	16	75.50	64	87	6.84
A	Height (cm)	14	164.50	152	180	7.45
B	Height (cm)	16	167.38	155	176	6.05
A	Disease duration (years)	14	7.14	1	20	5.32
B	Disease duration (years)	16	6.02	0.25	25	6.06

THE TEST PROCEDURE

The research applied the scale of the pain VAS (Visual Analogue Scale) and a survey assessing pain intensity according to the Laitinen scale. Thus the subjective perception of the intensity of pain was assessed by means of these two surveys. The subjects were referred to therapy by a specialist doctor or a rehabilitation doctor and asked to assess pain before treatments, immediately after a series of ten treatments and one month after completion of the therapy.

Local cryotherapy was conducted with the Kriopol device used for local cooling of the body surface by means of nitrogen vapours, which at the nozzle reached

a temperature of -160°C. The hip joint was cooled down frontally and medially in the groin area and the space between the symphysis and adductors of the thigh as well as posteriorly from the fold of the gluteal muscle and the ischiatic tuber. The distance of the nozzle from the treatment area was 15 cm. The procedure time was up to 3 minutes, depending on the subjective sensation of the patient who had been informed of the possibility to end the procedure in case of burning, tingling, pain and discomfort. 10 treatments were applied within two weeks (5 treatments from Monday to Friday).

In the study laser therapy was performed using a therapeutic diode laser Doris CTL model 1106MX, 780 nm-500 mW. A semiconductor diode is a source of radiation. The laser generates a continuous radiation of a regular power, which allows performing efficient transdermal and superficial, non-invasive and non-chemical therapeutic procedures. The dosage to painful points of the hip was P = 130 mW, E = 15 J/cm^2, f = 2000–3000 Hz. The dosage changed depending on the progress of the degenerative disease, the degree of pain intensity and the patient's general condition.

In the treatment of pain after cryotherapy exercise on a stationary bike was applied [19]. Riding a bicycle ergometer is an exercise influencing reconstruction of the muscle mass and improving the range of motion in the hip. The saddle was adjusted so that when seated the knees were almost straight and the soles of feet slightly touched the pedals. The ride began with several backward movements only to efficiently and comfortably go on to pedalling forwards. Depending on their strength and general condition, patients exercised so for 15 to 20 minutes 5 times a week for a period of two weeks. Before and afterwards blood pressure was measured.

RESULTS

Materials for the quantitative analysis in the study were obtained with a use of the questionnaire surveys: Indicators of Pain by Laitinen and Pain Assessment Scale by Barbara Heardley (VAS). Results of the study calculated with student's T-test, the tested values before the study, immediately after treatments and one month after the end of therapy in Group A are presented in Table 2, while in Group B in Table 3 An analysis of the results conducted with student's T-test for dependent groups confirms the effectiveness of both applied therapeutic methods. Reducing the sensation of pain in group A proved statistically significant at $p = 0.0003$ and in group B at $p = 0.0000$. In terms of reducing the incidence of pain in group A the level of significance was at $p = 0.0000$ immediately after a series of treatments, and one month after the end of the therapy it was also at $p = 0.0000$. In Group B directly after all treatments it was at $p = 0.0002$ and a month later at $p = 0.0000$. Reducing the use of analgesics in group A also proved to be statistically significant immediately after treatment at $p = 0.0142$, and a month later there was a further improvement with $p = 0.0099$. In group B after 10 treatments significance was by far at a higher level and amounted to $p = 0.0002$, and after a month it further improved at $p = 0.0001$. Statistical analyses showed that treatments in group A contributed to a reduction in restrictions on motor activity with significance at $p = 0.0011$ and after a month at $p = 0004$. In group B the significance was clearer and amounted to $p = 0.0001$ immediately after therapy and a month later to $p = 0.0000$. To summarize,

the outcomes of the therapy in both groups improved the patients' condition both after a series of procedures and one month after the last procedure.

Tabele 2. Analysis of results performed using Student t test in group A

Test T-student Group A - Cryotherapy and laser	Mean	SD	T	df	*p*	Change
Degree or pain before therapy	6.07	2.27				
Degree or pain after therapy	3.57	2.06	4.79	13	0.0003	41%
Frequency of pain before therapy	2.50	0.76				
Frequency of pain after therapy	1.21	0.70	10.26	13	0.0000	51%
Frequency of pain before therapy	2.50	0.76				
Frequency of pain 1 month after therapy	0.79	0.70	7.77	13	0.0000	69%
Use of medical painkillers before therapy	1.14	1.29				
Use of medical painkillers after therapy	0.57	1.09	2.83	13	0.0142	50%
Use of medical painkillers before therapy	1.14	1.29				
Use of medical painkillers 1 month after therapy	0.14	0.36	3.02	13	0.0099	88%
Limitation of physical activity before therapy	1.71	0.83				
Limitation of physical activity after therapy	0.86	0.53	4.16	13	0.0011	50%
Limitation of physical activity before therapy	1.71	0.83				
Limitation of physical activity 1 month after therapy	0.50	0.52	4.66	13	0.0004	71%

Tabela 3. Analysis of results performed using Student t test in group B

Test T-student Group B – Cryotherapy. laser and exercises on a bicycle ergometer	Mean	SD	T	df	*p*	Change
Degree or pain before therapy	5.38	1.78				
Degree or pain after therapy	2.88	2.03	5.98	15	0.0000	47%
Frequency of pain before therapy	1.88	0.81				
Frequency of pain after therapy	0.75	0.58	4.70	15	0.0002	60%
Frequency of pain before therapy	1.88	0.81				
Frequency of pain 1 month after therapy	0.50	0.52	6.21	15	0.0000	73%
Use of medical painkillers before therapy	1.13	0.96				
Use of medical painkillers after therapy	0.25	0.58	4.87	15	0.0002	78%
Use of medical painkillers before therapy	1.13	0.96				
Use of medical painkillers 1 month after therapy	0.06	0.25	4.98	15	0.0001	94%
Limitation of physical activity before therapy	1.06	0.68				
Limitation of physical activity after therapy	0.44	0.51	5.00	15	0.0001	59%
Limitation of physical activity before therapy	1.06	0.68				
Limitation of physical activity 1 month after therapy	0.25	0.45	5.98	15	0.0000	76%

Particular attention should be paid to the analysis of the measurement results immediately after the end of a series of treatments. Group B in which training on a bicycle ergometer was also applied achieved better therapeutic results. In group A the feeling of pain was reduced by 41% whereas in group B by 47%. In terms of reducing the incidence of pain in group A the improvement was by 51% and in group B by 60%. The use of painkillers in group A decreased by 50% while in group B by 78%. Reducing the restrictions on physical activity in group A was by 50% and in group B by 59%. To summarize, in order to reduce pain in patients with degenerative changes of the hip, physical therapy (laser therapy and cryotherapy) should be used in conjunction with movement (exercise on a bicycle ergometer).

DISCUSSION

Degenerative disease is considered to be a civilisation disease of the turn of the 20th and 21st centuries. The hip joint degenerates especially often, which when not treated leads to a substantial impairment of the patient's fitness. The goal of therapy in coxarthrosis is to slow down or prevent adverse destructive changes within the joint as well as to eliminate bothersome symptoms associated with pain ailments. Physical therapy plays an important role in alleviating pain. In conjunction with kinesiotherapy it effectively reduces the sensations of pain, increases or maintains the range of motion in the joint and reduces the increased muscle tone and strengthens the muscles [20]. Better therapeutic results in the form of a reduction in pain and an improvement in the efficiency of performing daily activities were observed after the additional use of motor activity following local cryotherapy [21]. After the application of 15 exercises and local cryotherapy procedures in patients with degenerative changes in both hip joints good healing effects were achieved in ambulatory physiotherapy [22]. This confirms that combining various physical methods, such as cryotherapy and laser therapy and selected kinesiotherapeutic exercises, increases the possibility of therapeutic influence. Analysis of own research proves high analgesic effectiveness of cryotherapy and laser therapy in combination with exercises on a bicycle ergometer. The use of physical treatments alone turned out to be less effective. Researchers confirm much better analgesic effects after simultaneous radiation with a laser beam and physical activity than after laser treatment alone [23, 24, 25].

In patients who were administered cryotherapy [16], laser therapy [26, 27] and kinesiotherapy [28] the sensation of pain significantly reduced. Among others a positive reaction mechanism of reducing the skin temperature on lowering the pain threshold reducing conductibility in nerve fibres, inhibiting nociceptors in the skin and inhibiting an inflammatory process, were confirmed. Studies indicate the validity of performing physical exercise after a cryotherapeutic procedure in order to improve the range of motion in joints, reduce muscle stiffness, improve their flexibility and endurance [16]. Other studies also confirm the analgesic anti-inflammatory, anti-oedematous effect and the improvement in mobility in the form of greater relaxation and better blood supply to muscles after laser therapy along with other selected therapeutic methods [26].

Based on the presented study results it can be concluded that daily physiotherapy administered to patients for 10 days (excluding Saturdays

and Sundays) has a significant impact on the reduction of pain ailments. The analgesic effect of these procedures allows significantly reducing or even eliminating pharmacological treatment and also influences an increase in physical activity.

CONCLUSIONS

The application of laser therapy and cryotherapy along with kinesiotherapy in the treatment of hip joint degeneration significantly reduces the sensation of pain after physiotherapeutic procedures.

The analysis of the results of the studied patients indicates that there has been a significant reduction in the incidence of pain and a reduction or complete elimination of painkillers after cryotherapy and laser therapy and performing exercises on a stationary bicycle for a month since the end of the therapy.

The study results show that physical treatments were combined with appropriately selected kinesiotherapy.

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