

ОРИГІНАЛЬНІ ДОСЛІДЖЕННЯ

DOI 10.64108/imh.2026.3.7.4

UDC 615.825+616.89-008.454

THE EFFECT OF A KINESIOTHERAPY PROGRAM ON THE FUNCTIONAL STATE OF THE KNEE JOINT IN CHILDREN WITH JUVENILE IDIOPATHIC ARTHRITIS

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Abstract. Juvenile idiopathic arthritis is the most common chronic rheumatic disease of childhood, characterized by prolonged autoimmune inflammation of the joints of unknown etiology, lasting more than six weeks and debuting before the age of 16. The disease has a progressive course and is often accompanied by the development of functional disorders of the musculoskeletal system, limited joint mobility, pain syndrome, morning stiffness and a gradual decrease in the quality of life of children.

According to modern clinical studies, knee joint damage is one of the most common manifestations of juvenile idiopathic arthritis and significantly affects the level of physical activity of patients. The consequences of a prolonged inflammatory process can be muscle weakness, contractures, gait disturbance, decreased range of motion and the formation of persistent functional limitations.

Purpose. To assess the effectiveness of an individualized kinesiotherapy program in children with juvenile idiopathic arthritis by analyzing changes in the functional state of the knee joint after a course of physical therapy.

Materials and methods. A prospective study was conducted with the participation of 20 children aged 7–15 years with juvenile idiopathic arthritis and unilateral knee joint damage. Patients were divided into control and experimental groups of 10 people each. The control group received a standard physical therapy program, while the experimental group additionally used an individualized kinesiotherapy program. Before and after the two-week rehabilitation course, the intensity of the pain syndrome was assessed using a visual analog scale (VAS), the amplitude of movements in the knee joint using goniometry, and clinical manifestations of the disease.

Results. Patients in the experimental group had a more pronounced reduction in pain, an increase in the amplitude of movements in the knee joint, and an improvement in functional activity compared to the control group.

Conclusions. 1. An individualized kinesiotherapy program is an effective component of complex physical therapy for children with juvenile idiopathic arthritis, which contributes to the improvement of the functional state of the knee joint and confirms the feasibility of its widespread implementation.

2. The use of specially selected physical exercises provides a more pronounced reduction in the intensity of pain, an increase in the amplitude of movements, and an improvement in functional activity compared to the standard physical therapy program.

3. Individualization of the rehabilitation program in accordance with the clinical course of the disease and the patient's functional capabilities increases the effectiveness of physical therapy and contributes to a faster restoration of motor functions.

4. The proposed program can be recommended for practical use by physical therapists in the comprehensive rehabilitation of children with juvenile idiopathic arthritis.

Keywords: physical therapy, rehabilitation, juvenile idiopathic arthritis, kinesiotherapy, children, knee joint diseases, knee arthritis, treatment.

Introduction. Juvenile idiopathic arthritis (JIA) is the most common chronic rheumatic disease in childhood, characterized by persistent autoimmune joint inflammation of unknown etiology that lasts longer than six weeks and has an onset before the age of 16 [2].

The disease follows a progressive course and is frequently accompanied by functional musculoskeletal impairments, limited joint mobility, pain, morning stiffness, and a gradual decline in the children's quality of life [1,

11].

According to modern clinical studies, knee joint involvement is one of the most common manifestations of JIA and significantly affects patients' physical activity levels. Consequences of the prolonged inflammatory process may include muscle weakness, contractures, gait abnormalities, reduced range of motion, and the development of persistent functional limitations [2, 15].

The modern treatment strategy for JIA involves com-

binning pharmacological therapy with physical therapy measures aimed at maintaining physical activity, preventing secondary musculoskeletal changes, and improving patients' functional status [6, 8, 12]. Kinesiotherapy is a leading physical therapy modality; it facilitates the gradual restoration of range of motion and improvements in muscle strength, coordination, and proprioception, while also helping to alleviate pain [4, 7]. Results of international studies indicate that individualizing rehabilitation programs enhances the effectiveness of physical therapy, improves the functional status of joints, and increases the level of daily activity in children with JIA [6]. At the same time, the issue of optimizing kinesiotherapy programs based on the clinical manifestations of the disease remains relevant and requires further research.

Study objective. To evaluate the effectiveness of an individualized kinesiotherapy program for children with juvenile idiopathic arthritis by analyzing changes in pain, knee joint range of motion, and functional status following a course of physical therapy.

Materials and methods. The study was conducted at the rheumatology department of the Ivano-Frankivsk Regional Children's Clinical Hospital. Twenty children aged 7 to 15 years with a clinically confirmed diagnosis of juvenile idiopathic arthritis (JIA) and unilateral knee joint involvement participated in the study. Patient enrollment followed a clinical assessment based on JIA diagnostic criteria and current clinical guidelines [2, 12, 15].

Patients were divided into two groups of 10. The control group underwent a standard physical therapy course comprising therapeutic exercises, activities to maintain mobility, and guidance on physical activity regimens and a home-based exercise routine. In the study group, in addition to the standard program, an individualized kinesiotherapy regimen was implemented; this targeted improving knee joint function, restoring full range of motion, strengthening lower-limb muscles, and alleviating pain [4, 6, 8]. The kinesiotherapy program was designed taking into account the patients' age, the clinical course of the disease, the severity of functional impairments, the intensity of pain, and individual tolerance to physical exertion. The exercise regimen included active and active-assisted movements, exercises to increase the range of knee flexion and extension, isometric and dynamic exercises to strengthen the quadriceps femoris muscle, and training for coordination, balance, and proprioception. The intensity of physical exertion was increased gradually, based on the child's functional status and clinical response to treatment [4, 7, 8].

Each session lasted 30–40 minutes. Sessions were conducted daily for two weeks under the supervision of a physical therapist. Particular attention was paid to proper exercise technique, pain management, and the prevention of overloading the affected joint [6, 9].

The program's effectiveness was assessed twice: before the start of the rehabilitation course and after its completion. A comprehensive assessment approach was used, involving clinical examination, goniometry, and the Visual Analogue Scale (VAS) for pain. Pain intensity was eval-

uated using the 10-point VAS, a widely used tool for the subjective assessment of pain in clinical practice [2]. Knee joint range of motion was measured using goniometry in accordance with standard methodological guidelines [3]. During the clinical examination, the presence of edema, morning stiffness, local tenderness, functional limitations, and gait characteristics was assessed [3, 5].

The obtained results were analyzed by comparing indicators before and after the completion of the physical therapy course in both groups. The primary criteria for effectiveness were changes in pain intensity, knee joint range of motion, and the children's overall functional status.

The research methods employed comply with the 2008 Declaration of Helsinki and were approved by the Ethics Committee of Ivano-Frankivsk National Medical University (IFNMU) during the planning of a comprehensive research project—approved by the IFNMU Academic Council (Protocol No. 19 dated December 20, 2018)—titled «Development and improvement of organizational and methodological foundations of physical therapy for patients with abdominal and nervous system disorders» (state registration number 0119U000448).

Research results. Initial clinical assessment revealed that patients in both groups exhibited similar levels of functional impairment, characteristic of the active phase of juvenile idiopathic arthritis. The most frequent clinical manifestations included knee pain, morning stiffness, localized swelling, reduced active and passive range of motion, and gait abnormalities. Baseline parameters for the control and study groups did not differ significantly, ensuring the validity of the subsequent comparative analysis [2].

Following the completion of a two-week physical therapy course, positive changes were observed in both groups. However, the improvement in functional status was more pronounced among children in the study group who followed an individualized kinesiotherapy program. Specifically, a more significant reduction in pain intensity—measured on the VAS scale—was noted, demonstrating the efficacy of using specially selected physical exercises in the comprehensive rehabilitation of children with JIA [6].

Goniometric assessment results showed an increased range of flexion and improved full extension of the knee joint in both groups. However, the improvement was more marked in the study group, highlighting the effectiveness of an individualized approach to designing the physical therapy program. The restoration of joint mobility was accompanied by improved lower-limb functional capacity and a reduction in signs of functional impairment [4]. During the follow-up clinical assessment, positive changes were also observed regarding the reduction of swelling, local tenderness, and the duration of morning stiffness. Children in the study group returned to their usual physical activity levels more quickly, performed functional exercises with greater ease, and demonstrated improved movement coordination. Pain intensity (measured on the VAS scale) in the study group decreased from 6.8 ± 1.1 to 2.4 ± 0.8 points ($p < 0.05$), whereas in the control group, it decreased from 6.6 ± 1.0 to 4.1 ± 0.9 points ($p < 0.05$). The range of

knee flexion increased from $102.3 \pm 8.4^\circ$ to $128.7 \pm 6.2^\circ$, a significantly greater improvement compared to the control group ($p < 0.05$). These results indicate that the use of an individualized kinesiotherapy program has a positive impact not only on the local condition of the affected joint but also on the patients' overall functional status [6, 8].

Thus, the study confirmed that incorporating individualized kinesiotherapy into a comprehensive physical therapy regimen yields more pronounced improvements in clinical and functional outcomes compared to a standard rehabilitation program.

Discussion of results. The study results confirmed that incorporating an individualized kinesiotherapy program into the comprehensive physical therapy for children with juvenile idiopathic arthritis leads to a more pronounced improvement in the functional status of the knee joint compared to a standard rehabilitation program. These findings align with current understanding regarding the role of physical therapy as an integral component of the comprehensive treatment of children with rheumatic diseases [6, 8, 12].

Juvenile idiopathic arthritis is characterized by a chronic course and is accompanied by pain, reduced range of motion, muscle weakness, and functional impairments that negatively affect children's physical development and quality of life [1, 2]. Therefore, the timely application of physical therapy not only improves joint function but also helps prevent the development of contractures, muscle atrophy, and persistent motor impairments [4, 7].

The study established that the use of an individualized kinesiotherapy program resulted in a more significant reduction in pain intensity. These results can be attributed to the multifaceted impact of controlled physical activity on the functional state of the musculoskeletal system. Regular performance of therapeutic exercises improves blood supply to periarticular tissues, normalizes muscle tone, increases the elasticity of the muscle-ligamentous apparatus, and restores normal movement biomechanics [6, 8, 14]. The positive trend in goniometric measurements demonstrates the effectiveness of the proposed program in restoring the range of motion in the knee joint. Improved functional mobility is of significant clinical importance, as it enhances self-care capabilities, facilitates the performance of daily activities, and supports the children's return to their usual level of physical activity [4].

These results align with findings from international studies emphasizing that individualized physical therapy

programs are more effective than standardized exercise regimens, as they take into account the clinical course of the disease, the patients' functional capabilities, and their level of physical fitness [5].

However, the study has certain limitations. Primarily, these include the small sample size and the short follow-up period, which preclude an assessment of the long-term impact of kinesiotherapy on the functional status of children with JIA. Promising avenues for future research include increasing the sample size, employing standardized functional assessment scales, and analyzing quality-of-life indicators and long-term rehabilitation outcomes [13].

Conclusions.

1. An individualized kinesiotherapy program is an effective component of comprehensive physical therapy for children with juvenile idiopathic arthritis; it improves the functional status of the knee joint and supports the case for its widespread implementation. 2. The use of specially selected physical exercises results in a more pronounced reduction in pain intensity, an increase in range of motion, and improved functional activity compared to a standard physical therapy program.

3. Tailoring the rehabilitation program to the clinical course of the disease and the patient's functional capabilities enhances the effectiveness of physical therapy and facilitates faster recovery of motor functions.

4. The proposed program can be recommended for practical use by physical therapists in the comprehensive rehabilitation of children with juvenile idiopathic arthritis.

Future research prospects include the development and refinement of existing individualized kinesiotherapy programs for the comprehensive rehabilitation of children with juvenile idiopathic arthritis.

Funding. The study was conducted without financial support.

Conflict of interest. The authors declare no conflicts of interest regarding this study—whether financial, personal, authorship-related, or of any other nature—that could influence the study or the results presented in this article.

Author contributions: M.V. Zelinska: a) concept and design; c) provision of study materials; d) data collection and synthesis; e) analysis and interpretation of results; f) manuscript writing; b) administrative support; Yu.S. Kuravskaya: g) manuscript editing.

All authors have read and agreed to the published version of the manuscript.

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УДК 615.825+616.89-008.454

ВПЛИВ ПРОГРАМИ КІНЕЗІОТЕРАПІЇ НА ФУНКЦІОНАЛЬНИЙ СТАН КОЛІННОГО СУГЛОБА У ДІТЕЙ ІЗ ЮВЕНІЛЬНИМ ІДІОПАТИЧНИМ АРТРИТОМ

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Резюме. Ювенільний ідіопатичний артрит є найпоширенішим хронічним ревматичним захворюванням у дитячому віці, яке характеризується тривалим автоімунним запаленням суглобів невстановленої етіології, що триває понад шість тижнів та дебютує до 16-річного віку. Захворювання має прогресуючий перебіг і нерідко супроводжується розвитком функціональних порушень опорно-рухового апарату, обмеженням рухливості суглобів, больовим синдромом, ранковою скутістю та поступовим зниженням якості життя дітей.

За даними сучасних клінічних досліджень, ураження колінних суглобів є одним із найчастіших проявів ювенільного ідіопатичного артриту та суттєво впливає на рівень фізичної активності пацієнтів. Наслідками тривалого запального процесу можуть бути м'язова слабкість, контрактури, порушення ходи, зменшення амплітуди рухів і формування стійких функціональних обмежень.

Мета. Оцінити ефективність індивідуалізованої програми кінезіотерапії у дітей із ювенільним ідіопатичним артритом шляхом аналізу змін функціонального стану колінного суглоба після курсу фізичної терапії.

Матеріали та методи. Проведено проспективне дослідження за участю 20 дітей віком 7–15 років із ювенільним ідіопатичним артритом та одностороннім ураженням колінного суглоба. Пацієнтів розподілили на контрольну та дослідну групи по 10 осіб. Контрольна група отримувала стандартну програму фізичної терапії, тоді як у

дослідній групі додатково застосовували індивідуалізовану програму кінезіотерапії. До початку та після завершення двотижневого курсу реабілітації оцінювали інтенсивність больового синдрому за візуальною аналоговою шкалою (VAS), амплітуду рухів у колінному суглобі методом гоніометрії та клінічні прояви захворювання.

Результати. У пацієнтів дослідної групи відзначалося більш виражене зменшення больового синдрому, збільшення амплітуди рухів у колінному суглобі та покращення функціональної активності, порівняно з контрольною групою.

Висновки. 1. Індивідуалізована програма кінезіотерапії є ефективним компонентом комплексної фізичної терапії дітей із ювенільним ідіопатичним артритом, що сприяє покращенню функціонального стану колінного суглоба та підтверджує доцільність широкого впровадження.

2. Використання спеціально підібраних фізичних вправ забезпечує більш виражене зменшення інтенсивності больового синдрому, збільшення амплітуди рухів та покращення функціональної активності, порівняно зі стандартною програмою фізичної терапії.

3. Індивідуалізація реабілітаційної програми відповідно до клінічного перебігу захворювання та функціональних можливостей пацієнта підвищує ефективність фізичної терапії та сприяє швидшому відновленню рухових функцій.

4. Запропонована програма може бути рекомендована для практичного використання фізичними терапевтами у комплексній реабілітації дітей із ювенільним ідіопатичним артритом.

Ключові слова: фізична терапія, реабілітація, ювенільний ідіопатичний артрит, кінезіотерапія, діти, захворювання колінного суглоба, артрит колінного суглоба, лікування.

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Дата першого надходження до видання 22.07.2026р.

Дата прийняття статті до друку після рецензування 05.08.2026р.

Дата публікації (оприлюднення) статті 30.09.2026р.