BrJP. São Paulo, 2019 jan-mar;2(1):88-92 **CASE REPORT**

Effects of hydrokinesiotherapy in pain, trophism and muscle strength in a child with juvenile idiopathic arthritis. Case report

Efeitos da hidrocinesioterapia na dor, no trofismo e na força muscular de uma criança com artrite idiopática juvenil. Relato de caso

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ABSTRACT

BACKGROUND AND OBJECTIVES: Juvenile idiopathic arthritis is a childhood rheumatic disease, which can interfere with the trophism and muscular strength of the individual due to persistent pain. Hydrokinesiotherapy may be an alternative in the management of this disease. The objective of this study was to verify the effects of hydrokinesiotherapy on pain, trophism and muscular strength of a child with juvenile rheumatoid arthritis.
CASE REPORT: Female patient, 12 years old, diagnosed with juvenile rheumatoid arthritis one year ago. The pain was evaluated by the visual analog scale and the body pain map, the muscular trophism by the perimetry of the arms and thighs, and the muscular strength by isokinetic dynamometry at a speed of 240º. The hydrokinetic therapeutic intervention program (adaptation, warm up, mobility and flexibility, muscle strengthening, cardiorespiratory fitness, balance and proprioception, and relaxation) was carried from October to December 2017, once a week, for 1 hour, totaling 10 sessions. At the end, there was a decrease in pain by 2.7 points (moderate to mild), an increase in muscle trophism of the arms and right thigh in 1cm and an increase in the torque peak (progress ranging from 12.3 to 37.9%) and total work (progress ranging from 18.6 to 76.7%) in all muscle groups analyzed in both knees.
CONCLUSION: The hydrokinetic therapeutic intervention plan shown to be an effective strategy to alleviate the pain and increase trophism and muscle strength of the individual with juvenile idiopathic arthritis.

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RESUMO

JUSTIFICATIVA E OBJETIVOS: A artrite idiopática juvenil é uma doença reumática da infância, que pode interferir no trofismo e na força muscular do indivíduo, devido à dor persistente. A hidrocinesioterapia pode ser uma alternativa no manuseio dessa doença. O objetivo deste estudo foi verificar os efeitos da hidrocinesioterapia na dor, no trofismo e na força muscular de uma criança com artrite reumatoide juvenil.
RELATO DO CASO: Paciente do sexo feminino, 12 anos de idade, diagnosticada com artrite reumatoide juvenil há um ano. Avaliou-se a dor por meio da escala analógica visual e do mapa de dor corporal; o trofismo muscular, por meio da perimetria dos braços e das coxas; e a força muscular, por meio da dinamometria isocinética em velocidade de 240º. O programa de intervenção hidrocinesioterapêutica (adaptação, aquecimento, mobilidade e flexibilidade, fortalecimento muscular, condicionamento cardiorrespiratório, equilíbrio e propriocepção e relaxamento) foi realizado nos meses de outubro a dezembro de 2017, uma vez por semana, durante 1 hora, totalizando 10 sessões. Ao fim, houve diminuição da dor em 2,7 pontos (de moderada a leve), aumento do trofismo muscular dos braços e da coxa direita em 1cm e aumento do pico de torque (progresso que variou entre 12,3 e 37,9%) e do trabalho total (progresso que variou entre 18,6 e 76,7%) em todos os grupos musculares analisados, de ambos os joelhos.
CONCLUSÃO: O plano de intervenção hidrocinesioterapêutica mostrou-se como uma estratégia eficaz para o alívio da dor e aumento do trofismo e da força muscular do indivíduo com artrite idiopática juvenil.

Descritores: Artrite juvenil, Dor crônica, Fisioterapia, Força muscular, Hidroterapia, Sistema musculoesquelético.

INTRODUCTION

Juvenile idiopathic arthritis (JIA) is a pediatric rheumatic disease characterized by persistent inflammation of the joints, with onset before the child reaches the age of 16. The annual occurrence varies from 2 to 20 cases per 100,000 people, with a prevalence of 15 to 150 cases per 100,000 people[1,2]. Even though its etiology is as yet unknown, evidence points to genetic predisposition[3].
The clinical conditions may include systematic manifestations, together with fever and inflammatory musculoskeletal bouts, including

evidence of inflammation of the joints (pain, heat, redness, swelling, and loss of function), stiffness, cramp, tenosynovitis, contractures, atrophies, and muscular weakness, thereby leading to functional incapacity and general malaise[3-5]. As a rule, these patients also show dysfunctions and defects of the lower limbs[2], especially on the knees, the ankles, the hips, and the minor joints of hands and feet[5].
Approaches seeking the rehabilitation of children and teenagers with JIA have been exploited, but lack standardization in their protocols[2]. Hydrokinesiotherapy is considered one of the most promising interventions, bringing relief of pain, muscular relaxation, flexibility, and preservation or restoration of the functional capacity. The properties of water allow movement of the painful musculature, mobilizing and strengthening it through specific exercises[3], being considered a safe strategy for this segment of the population[6].
The purpose of this study was to check the effects of hydrokinesiotherapy on pain, trophism, and muscular strength, in a child with JIA.

CASE REPORT

This is a longitudinal and interventionist case report which is part of a project named "The Effects of Physiotherapeutic treatment in patients with rheumatic diseases. "The study was approved by the Research Ethics Committee for Research with Human Subjects, at the University of Passo Fundo, State of Rio Grande do Sul, Brazil, under protocol number 348,381, as established by resolution No. 466/2012 passed by the Brazilian National Health Council (CNS) and the Helsinki Declaration.
The Free and Informed Consent Form (FICT) was signed by the girl's mother, after an explanation of the procedure and elucidation of any questions. Next, the participant was referred to the Rheumatology Physiotherapy Department of the Physiotherapy Clinic, which is part of the School of Physical Education and Physiotherapy of the University of Passo Fundo (UPF), in the city of Passo Fundo, State of Rio Grande do Sul, Brazil.
Female patient, aged 12, and diagnosed with JIA a year ago. She lived in the city of Passo Fundo, State of Rio Grande do Sul and was attending the 7th year of primary education. At the initial evaluation, her mother reported that "the child started with fever, pain, and swelling in her joints, back in October 2016. At that time, she was hospitalized for five days and diagnosed with JIA. In May, she had a crisis and almost lost her ability to walk due to the pain and the swelling" (according to information collected). The child also complained of pain in her right foot, of the "pressing" type, with a score of 7, which got worse during the night and then improved during movement (according to information collected). She was taking five different drugs of continuous use: Predsim®; Methotrexate®; folic acid; calcium; vitamin D; and Omeprazole®). She did not show any associated diseases, and neither any family history of rheumatic disease.
The pain was analyzed through the visual analog pain scale (VAS) and also through the map of body pain. The first consists of a horizontal straight line numbered from zero (no pain) to 10 (the worst pain you can imagine)[7]. The pain is classified as light (zero to 2), moderate (3 to 7) or intense (8 to 10).
The latter is an instrument that included a graphic representation of the human body from anterior and posterior view, where the patient identifies the points where he or she feels pain at the moment of the evaluation[3,8].
Muscular trophism was evaluated through perimetry, a test which uses a measuring tape to establish the circumference of a specific body segment[3]. In the study, the muscular trophism in the arms (10 and 15cm above the olecranon) and the thighs (10 and 15cm above the center of the patella), standards mentioned in another study conducted on an individual with rheumatoid arthritis[9].
Muscular strength was analyzed by isokinetic dynamometry, using the *Biodex*™ Multi-Joint System 3 Pro computerized isokinetic dynamometer, which is considered to be the gold standard for evaluation of muscular strength[3]. Preliminary studies[10,11] have shown that this equipment could even be used among the pediatric population, as it shows good reliability and can be easily applied for this procedure, with its limitations being easily overcome.
Initially, the child had a five-minute pre-warming up session on a Movement BM 2700 electromagnetic bicycle, with no load, and with the seat adjusted to the appropriate height for the child. Next, the child received information about the procedure that would be carried out. The dynamometer was moved along the horizontal plane and positioned on the external side of the unaffected lower limb. The accessory of the knee was then connected to the dynamometer, and the rotation axis of the subject's knee was brought into alignment with the axis of the dynamometer. The height of the seat was also adjusted, in the direction of the dynamometer. The patient was then stabilized by a pair of elbow belts, a pelvic belt, and a belt for the contralateral thigh. After the preparation, the child performed three movements of extension and bending of the knee, at the speed of 180° to learn the test procedure. The action took place through a series of five movements of extension and bending of the knee, in a concentric way, always assessing the extensor and flexor muscles of the knee, considering the average peak torque (maximum strength) and the total value of isokinetic muscular work, at a speed of 240°. The procedure was repeated, on the other side.
After evaluations, the child was then subjected to 10 individual sessions of hydrokinesiotherapy of approximately one hour (10 weeks), from October to December 2017. The intervention took place in a therapeutic pool, heated to a temperature of 36°C, based on referenced studies[12,13], to produce effects on the situation of pain, trophism, and the muscular force of the individual. Table 1 shows the hydrokinesiotherapy schedule.
The patient was advised to exhale during muscular contraction, to better recruitment of muscle fibers, which improves the performance of the exercise. There was an interval of 30 seconds to one minute between the series or cycles, but the patient could interrupt the activity for a rest whenever needed, conduct adopted in a previous study[14]. After the 10 sessions of hydrokinesiotherapy, all parameters were reassessed. Table 2 shows the reference values for the child's pain, in phases before and after hydrokinesiotherapy.
There was a reduction of the score and the intensity of the pain, after the intervention. However, pain started to be reported in more than one place. Table 3 shows the reference values for the muscular trophism of the patient, before and after intervention with hydrokinesiotherapy.
After the physiotherapy, the patient showed an increase of 1cm in all measurements of muscle trophism of the arms, and 15cm above the anatomical reference point of the right thigh, after the

Table 1. Hydrokinesiotherapy schedule, Passo Fundo, Rio Grande do Sul, Brazil, 2018

Phases	Exercises	Progression
Phase 1 – Adaptation (from the 1st to the 3rd session)	Walking around the pool, facing forward, sideward and backward.	3 rounds, in each direction
	Diaphragmatic respiratory exercise, where the individual should exhale under water.	3 series with 5 repetitions each.
Phase 2 – Warming Up	Slow muscular stretching, maintained, in either an active-assisted or passive mode, using the main muscular groups of the upper limbs, lower limbs, and trunk.	30 seconds for each muscle group
	Circular movements of shoulders, neck, wrists, and ankles	30 seconds for each joint
Phase 3 – Mobility and Flexibility	Rotation of trunk with floaters around the arms	1st to 5th session: 2 series with 10 repetitions each → 6th to 10th session: 3 series with 8 repetitions each
	Mobilization of wrists (active movements of flexion and extension) with floaters	1st to 5th session: 2 series with 10 repetitions each → 6th p 10th session: 3 series with 8 repetitions each
	Mobilization of ankles (movements of dorsiflexion and plantar flexion) on a submerged step	1st to 5th session: 2 series, with 10 repetitions each → 6th to 10th session: 3 series with 8 repetitions each
Phase 4 – Muscular strengthening	Strengthening of the hands (movements of manual prehension and also finger tweezers) with a "mild" proprioceptive ball (1st to 5th session) and "moderate" (6th to 10th session)	1st to 5th session: 2 series, with 10 repetitions each → 6th to 10th session: 3 series with 8 repetitions
	Strengthening of the adductor and abductor muscles of the elbows, with floaters	1st to 5th session: 2 series, with 10 repetitions each → 6th to 10th session: 3 series with 8 repetitions
	Minicrouches on bipedal support (1st to 7th session) and unipodal support (8th to 10th sessions)	1st to 5th session: 2 series, with 10 repetitions each → 6th to 10th session: 3 series with 8 repetitions
Phase 5 – Cardiac and respiratory conditioning	Stationary running	1st to 5th session: 1 series of 60 seconds → 6th to 10th session: 2 series of 60 seconds each
	Side jumps along a length of 5 meters	1st to 5th session: 1 series, with 10 repetitions → 6th to 10th session: 2 series of 8 repetitions
	Lateral jumping jacks	1st to 5th session: 1 series, with 10 repetitions → 6th to 10th session: 2 series of 8 repetitions
Phase 6 – Balance and proprioception	Stationary bicycle with two floaters between the legs	1st to 5th session: 60 seconds → 6th to 10th session: 2 series of 8 repetitions
	Lift the lower limb with a floater, under the foot, first with the knee bent (1st to 7th session) and then progressing to exercise with the knee outstretched (8th to 10th session)	1st to 5th session: 2 series of 10 repetitions → 6th to 10th session: 3 series of 8 repetitions
Phase 7 – Relaxation	Massotherapy on the cervical region, joint mobilizations on the ankle and the spine, and movements of the Watsu Method3.	1st to 5th session: 15 minutes → 6th to 10th session: 10 minutes

→ = progression of the exercise.

Table 2. Pain experienced before and after the hydrokinesiotherapy. Passo Fundo, Rio Grande do Sul, Brazil, 2018

Variables	Before intervention	After intervention
Point score according to VAS	5.0±2.86 (0-8) points	2.3±1.94 (0-4) points
Intensity of pain	Moderate	Light
Location of pain	Metatarsi and phalanges of the right foot	Posterior region of the right and left ankles

Mean ± standard deviation (minimum – maximum); VAS = visual analog scale.

Table 3. Muscular trophism of the patient, before and after hydrokinesiotherapy. Passo Fundo, Rio Grande do Sul, Brazil, 2018

	10cm above the center of the patella		15cm above center of the patella	
	Before intervention	After intervention	Before intervention	After intervention
Right Arm*	24cm	25cm	26cm	27cm
Left Arm	24cm	25cm	26cm	27cm
Right Thigh**	43cm	43cm	45cm	46cm
Left Thigh	44cm	42cm	48cm	46cm

cm = centimetres; * = dominant side; ** = dominant and affected side.

Table 4. Muscle strength of the patient's knees, before and after the hydrokinesiotherapy. Passo Fundo, Rio Grande do Sul, Brazil, 2018

Peak of torque				
Knee	Muscle Group	Before intervention	After intervention	Progress
Right*	Extensor muscles	62.6 N m	70.3 N m	12.3%
	Flexor muscles	23.8 N m	32.8 N m	37.9%
Left	Extensor muscles	58.9 N m	70.4 N m	19.4%
	Flexor muscles	22.9 N m	25.8 N m	12.7%
Total Work				
Knee	Muscle Group	Before intervention	After intervention	Progress
Right*	Extensor muscles	242.3 J	287.4 J	18.6%
	Flexor muscles	94.1 J	132.4 J	40.6%
Left	Extensor muscles	153.9 J	272.0 J	76.7%
	Flexor muscles	70.0 J	101.5 J	45.0%

N m = Newton-metre; J = Joule; % = relative value; * = dominant and affected side.

hydrokinesiotherapy. Table 4 shows the values for muscle strength on the patient's knees, before and after the hydrokinesiotherapy.

We see that the patient showed an increase in muscle strength in all parameters analyzed, after hydrokinesiotherapy. With regards to the peak of torque, the flexor muscles of the right knee had the best performance, followed by the extensor muscles of the left knee, flexors of the left knee, and extensors of the right knee. Concerning total work, the extensor muscles of the left knee had the best performance, followed by the flexor muscles of the left knee, the flexors of the right knee, and the extensors of the right knee.

DISCUSSION

Children and adolescents with JIA show a reduction in muscle strength in the knees when compared to their peers who do not have the disease[15]. In addition, these people are also subject to biomechanical consequences on the joints, such as a higher risk of cartilage lesions[16], as the muscles involved in this joint play a key role for stability and the prevention of lesions[17].

The muscle weakness as shown may be related to arthritis (which causes constant pain) and muscle atrophy due to lack of use of the affected joint[6]. This was the situation observed in this specific case, where the muscle weakness present in the patient's clinical condition was accompanied by pain, and these conditions could also influence the patient's muscular trophism. In addition, we can say that there is a consensus among professionals specialized in pediatric rheumatology, that regular physical exercises are a safe approach. Physical exercises also promote the child's general skills and the normal development in early childhood, not to mention the handling of musculoskeletal symptoms, such as reduction in muscle force, physical resistance, and aerobic capacity[18-20], with hydrokinesiotherapy being one of the main approaches used in rehabilitation in cases of JIA[21]. However, they also highlight that exercises on the floor bring better results in terms of muscle force, the execution of tasks, and functional state, compared with exercises in water[18], which is largely due to the significant heterogeneity in the results of the studies already produced. These studies stress the need for standardized evaluation or a basic set of functional and physical measures well suited to research in the health field[20].

The beneficial effects upon pain in the child with JIA also confirm the findings of other studies[12,13] that use hydrokinesiotherapy as a plan for treatment of pain, observing a reduction among the individuals treated, stressing the use of strengthening exercises in their protocols, as adopted in this study.

Confirming the results presented in this study, the literature says that hydrokinesiotherapy does not influence muscle strength in people with lower limbs disorders, due to the inconsistent methodologies in most studies, especially those related to the prescription of resistance exercises in a water[22].

The methodological design used in this study that analyzed the effects of hydrokinesiotherapy on muscle strength in a child with JIA by isokinetic dynamometer was observed in only one similar study. It was a study where 30 children with JIA were randomly distributed between a control group (n=15), subjected to conventional physiotherapy on the ground, and an intervention group (n=15), which was subjected to a specific hydrokinesiotherapy programme for lower limbs (5 minutes warming up, then 20 minutes of resisted exercise, and 5 minutes of cooling off), associated with the interferential current in the muscles of the anterior, posterior, medial and lateral sections of the hips (frequency of 100Hz, pulse duration of 125 Ksec at the sensorial threshold of the individual). After the intervention, the intervention group showed superior results when compared to the control group, regarding the increase in the peak torque of lower limbs and the reduction of the levels of pain[23]. In the present study, we confirmed that the plan for the hydrokinesiotherapy increased the peak of torque and also the total effort made by the extensor and flexor muscles of the knees, as well as easing the patient's intensity of pain, without the need for any additional resources.

The present report does have its limitations. Even though we have observed an improvement in muscle force and a reduction in pain intensity, we believe that the number and frequency of the sessions, which were lower than in most of the evidence presented in the literature, could have contributed to the fact that there was no evidence of an improvement in most measurements of muscle trophism of the patient's thighs. However, these circumstances did not hinder the generation of the data presented, seeking to contribute so that new studies are carried out, based on a more significant number of individuals, thereby allowing the solution of any questions that may have remained.

CONCLUSION

The plan for intervention through hydrokinesiotherapy showed to be an effective strategy for pain relief and the increase of trophism and muscle strength in a patient with JIA.

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