EFFICACY OF ISOKINETIC STRENGTH TRAINING ON FUNCTIONAL PERFORMANCE IN CHILDREN WITH HEMOPHILIA

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Abstract

Background: Recurrent hemarthroses, especially in weight-bearing joints, cause childhood haemophiliacs to frequently endure muscle weakening, joint instability, and functional impairments. Strength training with a specific focus could help lessen these deficiencies. The effectiveness of an isokinetic strength training program on children with hemophilia's muscle strength, joint health, pain, and functional independence was examined in this study utilizing the Biodex Isokinetic Dynamometer.

Goal: To assess how isokinetic strength training affects children with hemophilia's functional performance, joint health, pain levels, and quadriceps and hamstring strength. Methods: Thirty children, ages eight to twelve, with moderate to severe hemophilia A or B, participated in a randomized controlled experiment. A control group (design physical therapy programme) and an intervention group (isokinetic training plus design physical therapy programme) were created from the participants. For eight weeks, the intervention group received three sessions per week of supervised isokinetic training on the Biodex dynamometer. Among the outcome measures were: Biodex measures muscle strength (peak torque at 60°/s and 120°/s).

The Visual Analogue Scale (VAS) is used to measure the intensity of pain. The Functional Independence Score in Hemophilia (FISH) evaluates functional competence. The Haemophilia Joint Health Score (HJHS) is used to measure joint health. Both before and after the intervention, assessments were carried out.

Results: When compared to the control group, the isokinetic training group demonstrated statistically significant gains in muscle strength ($p < 0.01$), decreased VAS pain scores ($p < 0.05$), improved functional independence on FISH ($p < 0.01$), and improved joint health scores on the HJHS ($p < 0.05$).

Conclusion: It could be concluded that children with hemophilia can benefit from isokinetic strength training with the Biodex system, which is a safe and efficient way to increase muscular strength, lessen pain, strengthen joints, and encourage functional independence. There may be significant clinical advantages to integrating systematic isokinetic training into standard rehabilitation.

Keywords: Hemophilia, Isokinetic training, Biodex dynamometer.

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Introduction

A sex-linked hereditary condition called hemophilia is brought on by a lack of coagulation factors. Hemophilia is regarded as the most serious blood coagulation illness, while being an uncommon condition. [1] Hemophilia affects 1–10,000 people total [2]. Hemophilia comes in two common forms. The most prevalent forms of hemophilia are hemophilia A (80%), which is caused by a deficiency in F VIII, and hemophilia B (20%), which is caused by a lack in F IX.

Acquired hemophilia, the rarest kind of hemophilia, is usually seen in the elderly and is caused by an antibody-mediated autoimmune reaction to F VIII [3].

Coagulation factor levels in the blood determine the severity of hemophilia (1 international unit = 1%). Hemophilia can be categorized as mild (>5-<40%), moderate (1-5%), or severe (<1%) [4]. Mild bleeding episodes (low bleeding tendency), severe bleeding episodes (spontaneous), or even potentially fatal intra-abdominal or brain haemorrhages are also common in haemophiliacs [5].

70% to 80% of bleeding typically occurs in the joints. Shoulders, ankles, elbows, and knees are frequently impacted joints. The knee joint is most frequently damaged (45%) because it bears a lot of weight. Subchondral bone loss, a vicious cycle of pain, further intra-articular bleeding, abnormalities in bone development and lengthening, and short-term flexion contracture of the target joint are all consequences of repeated joint bleeding [6–8].

The coagulation factor shortage can be addressed with factor replacement therapy, which need to be initiated as soon as feasible. It works to keep the patient's deficient factor from dropping below 1% of normal levels. Prophylactic medication is costly, and developing nations' governments struggle to provide it to haemophilic patients regularly; instead, on-demand treatment is their only option [9,10,11].

In haemophiliacs, a sedentary lifestyle leads to issues related to inactivity, such as muscle weakness, poor balance, a higher risk of overweight children with hemophilia, joint instability, recurrent bleeding and joint damage, a decrease in aerobic capacity, and a decline in motor fitness. In order to enhance their performance, it is therefore strongly advised that they participate in sports and physical exercise as part of their complementary therapy [12,13].

Various techniques for increasing muscle strength, such as isometric, isotonic, or isokinetic workouts, rely on the patient's capabilities [14]. Using the isokinetic mode with kids is safe. It reduces the possibility of joint and muscular damage that could arise from attempting to regulate the load while one repetition-maximum testing with free weights [15].

In clinical rehabilitation as well as sports medicine, isokinetic and isotonic training are employed. The biomechanical properties of isokinetic and isotonic training with particular demands on the neuromuscular system are different. Variable angular velocity is used in isotonic movement, which only puts the most strain on the neuromuscular system at the weakest mechanical points in the range of motion while working at less than maximal capacity at the other angles. However, with isokinetic movement, a maximal effort can be felt, as though a maximum load were applied at every point along the arc of motion, and the resistance created is proportionate to the power applied [16].

Isometric and isokinetic exercises stimulate remodelling and repair, which is referred to as chondroprotective, and increase joint mobility. A maximal contraction at a consistent speed throughout the range of motion is possible with isokinetic exercise because the movement speed is regulated [17–19].

Compared to other rehabilitation techniques, isokinetic training is thought to offer significant advantages. The greater impact of isokinetic training may be attributed to the fact that weight training does not produce the maximum torque that may be obtained across the entire range of motion during isokinetic training [20, 21]. Thus, the purpose of this study was to look at how isokinetic exercise affected the functional ability, pain, and muscle strength of kids with hemophilia.

Materials and Methods

Participants

A total of 30 male children diagnosed with Hemophilia A or B, aged between 8–12 years, and presenting with unilateral hemarthroses, were recruited from Lawmen General Hospital -The Kingdom of Saudi Arabia. According to the World Federation of Hemophilia's Orthopedic Advisory Committee's suggested classification of hemophilia, all participants experienced knee joint issues (pain and bleeding) that ranged from mild to significant. [22] Informed consent was also obtained. Any participant who had undergone surgery six weeks before or during treatment, engaged in any other type of rehabilitation exercises during the study, experienced acute joint or muscle bleeding, or had advanced radiographic changes like bone destruction, bony ankyloses, knee joint subluxation, or epiphyseal fracture was excluded.

The sample size was calculated using G*Power software (version 3.1.9.4) based on previous studies with similar populations. With an effect size of 1.1, α level of 0.05, a power of 80%, and a t-test design, a minimum of 15 subjects per group was required. To account for possible dropouts (~6%), a total of 30 participants were included in the study.

Design and Randomization

This randomized controlled experiment, which took place between March 2025 and May 2025, was registered on ClinicalTrials.gov (registration number: NCT07035080 it involved 30 male children with a diagnosis of hemophilia A or B who were between the ages of 8 and 12 and who presented with unilateral hemarthroses. A control group and a study group were randomly assigned to each of the thirty youngsters. Physical treatment was customized for both groups, with isokinetic strength training being given to the Study Group. Using an Excel sheet, randomization was performed by listing the names of the patients in one column and using the RAND method to create random numbers in a second column. Next, in a third column, each patient was allocated to either Study Group I or II. The random numbers were arranged in ascending order to finally place the patients into their groups.

Outcome Measures

Biodex isokinetic dynamometer

The Biodex System 3 multi-joint system testing and rehabilitation (Biodex Medical System, Shirley, NY, USA) was used for all tests, and it was calibrated before to each test session. Isokinetic devices have been shown in prior research to be valid and reliable for assessing muscle strength in both adults and children [23]. At an angular velocity of 60 °/sec, the flexor and extensor muscles of the afflicted knee joint were assessed for eccentric and concentric peak torque and power.

The Visual Analogue Scale (VAS)

It is a line scale that runs horizontally and is ranked from 1 to 10. Ten positions indicate excruciating pain, while 1 to 10 represents progressively greater pain intensities [24].

Functional Independence Score in Hemophilia (FISH)

A straightforward method for properly evaluating haemophiliacs' functional skills is the Functional Independence Score in Hemophilia (FISH). About fifteen minutes are spent on administration. It is based on three primary categories: mobility (walking, climbing stairs, running), transfer (chair, squatting), and self-care (feeding, clothing, grooming, and bathing). Depending on the degree of independence and support required, each task is given a score between 1 and 4. The overall summation of each activity determines how the data are interpreted; it might be weak (8–18), moderate (17–24), or good (25–32) [25, 26]. Every participant's mobility in both groups was evaluated for this study.

The haemophilia joint health score HJHS

It used for the assessment of joint health in patients with haemophilia. The HJHS has developed into a vital resource for evaluating and tracking joint health in haemophiliacs. It is a fundamental component of clinical practice and research because of its validity, reliability, and adaptability. Notwithstanding its drawbacks, the HJHS offers a consistent, impartial assessment of joint damage, which is essential for enhancing prophylactic measures, monitoring the course of the disease, and enhancing patient outcomes. (27). The HJHS version 2.1 has been officially verified in both adults and kids (4–18 years old). 1, 2, and 4 The ankle, knee, and elbow joints as well as overall gait, are scored; a higher number denotes worse joint condition. The highest score for individual joints is 20, and the total score is 124. 1, 2, and 5 First, eight items are evaluated for each of the six specific joints (swelling 0–3, swelling duration 0-1, muscle atrophy 0–2, crepitus on motion 0–2, flexion/extension loss 0–3 each, joint discomfort 0–2, strength 0–4) to determine the overall score. The overall HJHS score is then determined by adding the total scores and the gait score (0–4). (28)

Interventions

Over the course of 8 consecutive weeks, the treatment program was administered to all children in both groups three times a week for 90 minutes each. While the children in the control group only received a specified rehabilitation program, the children in the research group underwent isokinetic training in addition to the program.

Isokinetic training program

In addition to a planned rehabilitation program, GI participants underwent isokinetic training. For 8 weeks, isokinetic training involved three sets of ten consecutive maximal concentric and eccentric isokinetic contractions performed three days a week at an angular velocity of 60º/sec. There were no breaks in between the ten contractions, and each set was preceded by a three-minute rest [29]. Verbal cues like "Push as hard and as fast as possible against the lever arm (concentric contraction) and at the end of extension; continue to push against the lever arm as it returns to the start position (eccentric contraction)" for knee extensors and vice versa for knee flexors are used to guide participants and provide motivation [30].

Designed rehabilitation program

The following is the identical designed rehabilitation program that was given to every child in both groups: Warm-up and cooling-down exercises: Ten minutes were dedicated to these activities each session. Children were instructed to sit on the bicycle ergometer's seat with their backs straight and supported. The usage of pedal straps ensured that the foot was fixed. To ensure stability throughout training, the kid was instructed to firmly grab the bicycle's handles with both hands. As a warm-up, the kid was instructed to bike for five minutes at a lower intensity. After each exercise, the participants were given an additional five minutes to cool down. (31).

Therapeutic ultrasonic: A 1MHz US frequency was set up to operate in a pulsed mode for 10 minutes at an intensity of 1.5W/Cm2. The subject was in a comfortable, relaxed supine resting position when it was applied to the knee joint. Alcohol was used to clean the skin of the knee joint, which was the treated area. Around the knee joint, a sufficient quantity of Aqua Sonic-Gel was administered [32].

Exercises for flexibility: After warming the tissue with physical activity, hamstring and calf muscle flexibility and joint range of motion were performed.

Stretching techniques that were gentle, low stress, and prolonged within the pain-free range were employed [33]. At least two minutes were spent on each stretch. A body part would be placed and externally stabilized with weights or straps in a stretched posture while other body parts were trained for efficacy with extended stretching lasting more than two minutes [34].

30 minutes of strengthening activities that include progressive functional strength-training routines. Three functional exercises made up the program: the half-knee-rise, lateral step-up, and sit-to-stand. To assess individual skills and establish the beginning level for the exercises, an eight-repetition maximum was completed prior to the start of the treatment program. Exercise repetition was progressively raised based on the patient's capacity. [35]

Resistance exercise training: Before beginning treatment, the child's repetition maximum the number of times they lifted a weight through their entire range of motion before becoming fatigued-was established [36]. Each person's skills were taken into consideration when designing the activities. Starting with a small weight, sand bags weighing between 2 and 6 kg were used. Until the amount of weight lifted was no longer difficult, each person was told to execute sets of repetitions, beginning with three sets of ten repetitions and progressing to three sets of fifteen repetitions with a two-minute rest time in between. The exercises were performed as close to their limits as possible in terms of muscular fatigue and pain. Knee flexors and extensors were trained using resistance exercises [37, 38] (Figure 1).

Data analysis

The baseline equivalence of the control and experimental groups on continuous demographic and anthropometric factors was evaluated using an independent samples t-test. Randomization was successful because no statistically significant differences were discovered ($p > 0.05$). For clarity, all numbers are shown to one decimal place; however, throughout statistical analysis, complete precision was maintained.

Results

As illustrated in (Table 1), an independent samples t-test was conducted to assess baseline equivalence between the control and experimental groups on continuous demographic and anthropometric variables. No statistically significant differences were found ($p > 0.05$), indicating successful randomization. All values are presented with one decimal place for clarity, while full precision was maintained during statistical analysis. A chi-square test revealed no statistically significant difference in hemophilia type distribution between the two groups (χ^2 = -, $p = 0.612$), supporting baseline comparability (Table 2).

A Mixed MANOVA was performed to examine the effects of time (pre vs. post) and group (control vs. experimental) across four dependent variables: muscle strength, functional performance, pain intensity, and joint evaluation score. The multivariate analysis revealed a significant interaction effect between time and group (Wilks' Lambda = 0.68, $p = 0.001$), indicating that the change over time differed significantly between the two groups. However, the main effect of group was not statistically significant ($p = 0.075$), suggesting that overall baseline differences did not affect outcomes. Effect sizes (partial eta squared) were reported to enhance interpretability given the small sample size (Figure 2).

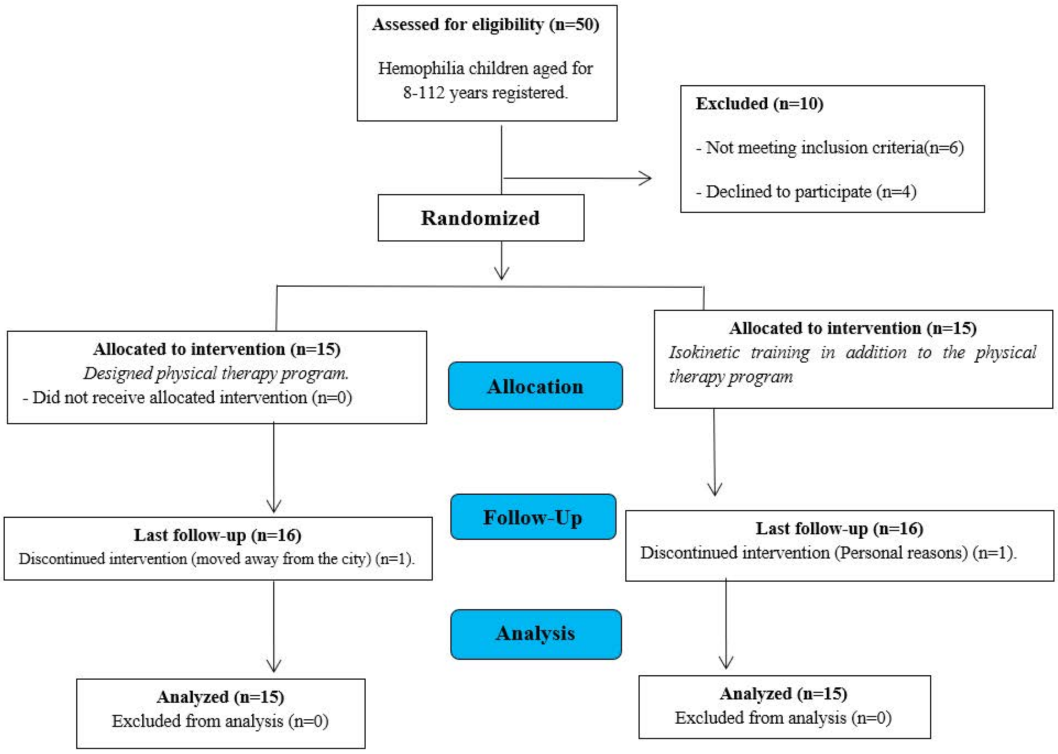

Figure 1. Consort flow chart for patients in the study.

Table 1. Baseline Equivalence Check Using Independent Samples t-test.

Variable	Control Group (N = 15) Mean ± SD	Experimental Group (N = 15) Mean ± SD	T-Value	P-Value	Significance
Age (years)	9.8 ± 1.3	10.2 ± 1.1	-0.987	0.331	NS
Height (cm)	132.4 ± 6.5	130.7 ± 5.9	0.856	0.398	NS
Weight (kg)	28.5 ± 4.2	27.9 ± 3.8	0.534	0.597	NS
BMI	16.2 ± 1.5	16.4 ± 1.3	-0.342	0.734	NS

NS = Not Significant (p > 0.05)

Table 2. Chi-square Test for Categorical Variables.

Hemophilia Type	Control Group (N = 15)	Experimental Group (N = 15)	X²-Value	P-Value	Significance
Type A	9	10	—	0.612	NS
Type B	6	5			

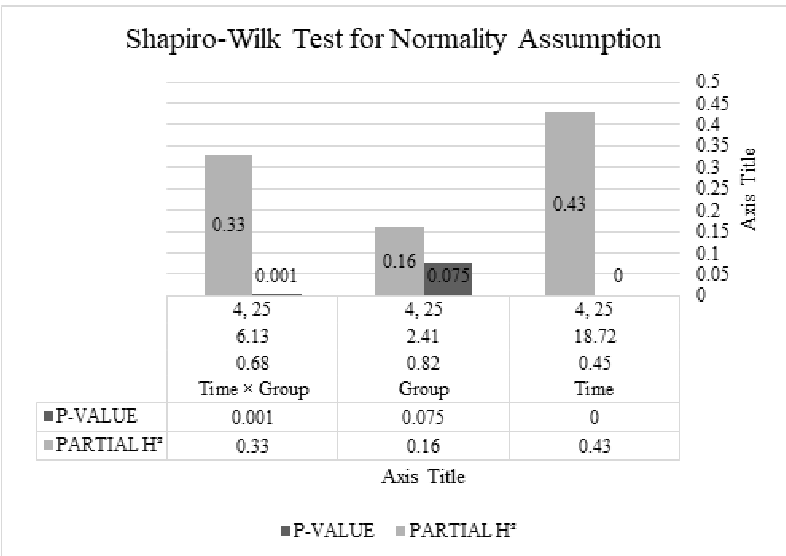

Figure 2. Shapiro-Wilk Test for Normality Assumption.

Paired t-tests were conducted to evaluate within-group changes from pre- to post-intervention. The experimental group showed significant improvements across all variables, while the control group showed minimal change (Tables 3-5).

To better understand how each outcome variable responded to the intervention, separate univariate repeated measures ANOVA were conducted. A Bonferroni correction was applied to adjust the significance level ($\alpha = 0.0125$ per test) due to multiple comparisons. Three out of four variables (muscle strength, functional performance, and pain intensity) showed statistically significant interaction effects ($p < 0.0125$), indicating that the intervention had differential effects between the two groups. Joint evaluation scores approached significance but did not reach corrected levels, suggesting limited sensitivity or smaller treatment effect for this variable.

A mixed MANOVA was conducted to examine the effects of time (pre vs. post) and group (control vs. experimental) on four dependent variables. A significant multivariate interaction effect was found for Time × Group (Wilks' Lambda = 0.68, $p = 0.001$), indicating differential changes over time between the two groups (Table 6 & Figure 3).

Three out of four variables showed statistically significant interaction effects after correction, indicating a meaningful intervention effect in the experimental group (Table 7).

Cochran's Q test revealed a statistically significant reduction in the presence of joint crepitus following the intervention ($\chi^2 = 5.20$, $p = 0.023$), suggesting positive joint health outcomes (Table 8).

Discussion

The purpose of this study was to examine how children with hemophilia would respond to more isokinetic exercise in terms of muscular strength, pain, mobility, and joint health. The primary conclusions of this study were that, in comparison to children who received a planned rehabilitation program alone (Group II), children who received additional isokinetic training (Group I) demonstrated a significant increase in isokinetic parameters (power, peak torque), a marked decrease in pain scores, and an improvement in mobility (upstairs, walking, and running) and improvement in HJHS lower score over time.

Table 3. Paired t-tests for Within-Group Pre-Post Comparisons.

Variable	Control Group Pre–Post	T-Value	P-Value	Experimental Group Pre–Post	T-Value	P-Value
Functional Performance (Y)	0.4 ± 1.0	0.72	0.48	3.1 ± 1.2	5.03	<0.001
Pain Intensity (Z)	-0.1 ± 0.8	-0.21	0.84	-1.9 ± 0.9	-4.32	<0.001
Joint Heath score (U)	0.0 ± 0.6	0.00	1.00	0.7 ± 0.5	3.06	0.009

Table 4. Statistical analysis of concentric and eccentric peak torque at 60º/sec of the knee flexors and extensors within each group and between groups.

Item	Group	Pre (X±SD)	Post (X±SD)	t-value	p-value
Eccentric flexor torque	Group I	28.29 ± 5.33	41.80 ± 3.65	-11.44	0.000**
	Group II	26.36 ± 4.31	34.50 ± 4.08	-6.66	0.000**
	t-value	-0.89	-4.21		
	p-value	0.38	0.001		
Concentric flexor torque	Group I	23.81 ± 5.81	38.15 ± 3.9	-12.02	0.000**
	Group II	21.97 ± 4.13	28.46 ± 4.26	-8.47	0.000**
	t-value	-0.79	0.436		
	p-value	-5.309	0		
Eccentric extensor torque	Group I	35.44 ± 7.77	45.21 ± 7.74	7.7	0.000**
	Group II	32.17 ± 3.09	37.23 ± 4.34	4.104	0.003**
	t-value	-1.2	0.245		
Concentric extensor torque	Group I	30.80 ± 7.18	46.10 ± 7.00	11.17	0.000**
	Group II	28.56 ± 3.18	32.10 ± 5.25	2.6	0.029*
	t-value	-0.907	0.376		
	p-value	-2.8	0.011		

Table 5. Statistical analysis of concentric and eccentric peak power at 60º/sec of the knee flexors and extensors within each group and between groups.

Item	Group	Pre (X±SD)	Post (X±SD)	t-value	p-value
Eccentric flexor torque	Group I	28.29 ± 5.33	41.80 ± 3.65	-11.44	0.000**
	Group II	26.36 ± 4.31	34.50 ± 4.08	-6.66	0.000**
	t-value	-0.89	-4.21		
	p-value	0.38	0.001		
Concentric flexor torque	Group I	23.81 ± 5.81	38.15 ± 3.9	-12.02	0.000**
	Group II	21.97 ± 4.13	28.46 ± 4.26	-8.47	0.000**
	t-value	-0.79	0.436		
	p-value	-5.309	0		
Eccentric extensor torque	Group I	35.44 ± 7.77	45.21 ± 7.74	7.7	0.000**
	Group II	32.17 ± 3.09	37.23 ± 4.34	4.104	0.003**
	t-value	-1.2	0.245		
Concentric extensor torque	Group I	30.80 ± 7.18	46.10 ± 7.00	11.17	0.000**
	Group II	28.56 ± 3.18	32.10 ± 5.25	2.6	0.029*
	t-value	-0.907	0.376		
	p-value	-2.8	0.011		
	p-value	0.032	0.03		
Concentric extensor power	Group I	20.77 ± 1.34	30.84 ± 1.31	-18.29	0.000**
	Group II	19.87 ± 1.56	23.73 ± 2.26	-5.03	0.001**
	t-value	-0.138	-8.61		
	p-value	0.184	0.000**		

Table 6. Mixed MANOVA Multivariate Results.

Effect	Wilks' Lambda	F-Value	Df	P-Value	Partial H²
Time	0.45	18.72	4, 25	<0.001	0.43
Group	0.82	2.41	4, 25	0.075	0.16
Time × Group	0.68	6.13	4, 25	0.001	0.33

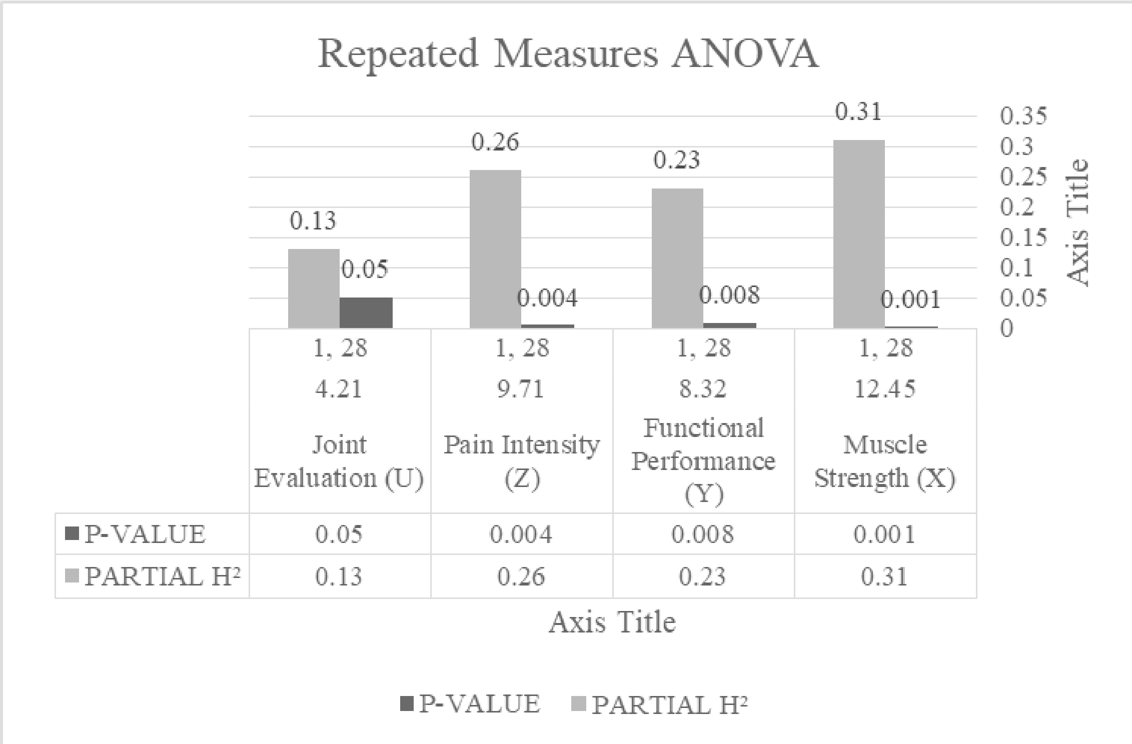

Figure 3. Repeated Measures ANOVA.

Table 7. Repeated Measures ANOVA with Bonferroni Correction.

Variable	Source	F-Value	DF	P-Value	Partial H²	Sig. After Bonferroni
Muscle Strength (X)	Time × Group	12.45	1, 28	0.001	0.31	Yes
Functional Performance (Y)	Time × Group	8.32	1, 28	0.008	0.23	Yes
Pain Intensity (Z)	Time × Group	9.71	1, 28	0.004	0.26	Yes
Joint Evaluation (U)	Time × Group	4.21	1, 28	0.050	0.13	No

Bonferroni-corrected significance level: α = 0.0125 (0.05 ÷ 4 comparisons).

Table 8. Cochran's Q Test for Presence of Joint Crepitus (Categorical Repeated Measure).

Condition	Pre-Intervention (Positive)	Post-Intervention (Positive)	X²-Value	P-Value	Significance
Presence of Joint Crepitus	10	6	5.20	0.023	Yes

Significant improvements in the concentric and eccentric peak torque and power of the knee flexors and extensors scores in both groups were observed in the current study. This could be explained by the physical therapy exercise program that was created with the goal of improving the affected lower limb's motor performance. This consequently enhanced the lower limb's muscle strength during both concentric and eccentric exercise (flexion and extension), which is necessary for daily living activities.

This explanation supports the finding of Núñez-Cortés et al. [39], who claimed that exercise is safe for those with hemophilia. Additionally, he stated that the exercise regimen prescribed for haemophiliac patients aids in improving self-image, preventing psychological issues, diminishing body fat, increasing ROM and joint stability, improving functional capacities, and strengthening muscles.

According to Rameckers et al. [34], functional strength training is a safe program that is frequently utilized in both adult and Pediatric rehabilitation. This is in line with their findings. According to Siwi, et al.'s research [19], functional workouts like stair climbing, standing up from a sitting position, and sitting into a chair enable the knee flexors and extensors to contract eccentrically and concentrically, which supports the findings.

Improved mobility and a notable reduction in pain levels in both groups may be attributed to the use of ultrasound (US). Rameckerset al.'s findings [40] supported this, stating that adequate intervention and rehabilitation activities improve muscular strength and overall discomfort and function in individuals with knee diseases. Consistent with other reports [41,42]. US is regarded as a successful treatment technique that promotes cartilage repair. Subjects with knee diseases benefit from US's anti-inflammatory properties, which let them perform better and experience less discomfort. Enhancement in cell metabolism and tissue regeneration capacity has been demonstrated by the US.

Strengthening the muscles and relieving the pain in those kids may lead to an improvement in mobility in both groups. This explanation is supported by Waleed et al.'s findings [43], which indicated a substantial relationship between quadriceps muscle strength and maximal walking speed. The findings are consistent with those of -Rodrigues et al. [44], who found that strength training promotes muscle mass (hypertrophy), enhances muscle power and strength, improves bone mineral density and postural balance, lowers the risk of falling, speeds up walking, increases stair climbing strength, and alleviates knee disease symptoms in participants.

Similar findings were made by Rameckers et al. [34], who noted that improved muscle strength, circulation, endurance, and cardiopulmonary efficiency all contribute to a more pleasant and effective gait. Functional walking is also thought to be enhanced by improved body image, social well-being, confidence, and a reduced fear of movement or damage.

The current study's findings indicated that Group I had improved more than the other groups in the evaluated variables. This discrepancy could be explained by the impact of isokinetic training. This theory is corroborated by Missmann et al.'s findings [45], which showed that subjects who receive regular training at varying angular velocities improve their strength gain. It is possible to ascribe the strength gain to either neutrally mediated or

because of modifications to the architecture of muscles and/or their contractile characteristics. According to Nunes et al. [46], rehabilitation regimens should incorporate strong isotonic exercises to produce neuromuscular activation levels high enough to promote muscle growth and strength. This viewpoint backs up the better outcomes obtained in Group I. This is also in line with -Karami et al.'s findings [47], which showed that isokinetic training helps to strengthen muscles and enhance joint position awareness.

A recent systematic review and meta-analysis explained that following the use of various physical therapy procedures, including manual therapy, physical agent modalities, therapeutic exercises, and other therapies, our meta-analysis revealed significant improvements in all ICF dimensions. Therapeutic exercise and manual therapy methods could enhance haemophilic arthritic patients' joint health and quality of life. Additionally, laser therapy may help juvenile patients with haemophilic arthroplasty have less pain. Physical therapy interventions are safe for managing hemophilia, according to the majority of included research, with no adverse effects like bleeding (48,49,50).

Strong evidence was presented by our systematic review and meta-analysis supporting the use of therapeutic exercise modalities and manual treatment to enhance joint health status in conjunction with educational sessions to enhance the quality of life for patients with haemophilic arthroplasty. Using Nd: YAG or high-intensity laser therapy appears to be promising for reducing pain in children with haemophilic arthroplasty.

Adults with haemophilic arthroplasty may benefit from therapeutic exercise to increase their muscle strength and functional ability. Additionally, children with haemophilic arthroplasty may benefit from laser therapy in terms of their gait (51-57).

Conclusion

The results of this study show that isokinetic strength training is a useful strategy for enhancing children with hemophilia's functional performance. Participants demonstrated notable increases in muscle strength, reduced pain, and enhanced child mobility after completing an organized and supervised isokinetic exercise program.

Ethics approval

The study was approved by the Faculty of PT, Kafr Elsheikh University Ethical Committee (KFSIRB200-497.). Consent to participate. Informed consent was obtained from the parents or legal guardians of all participants included in the study.

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