THE EFFECT OF MAGNETIC THERAPY AND REHABILITATION EXERCISES ON IMPROVING SOME PHYSICAL AND MOTOR ABILITIES AND REDUCING PAIN IN CHILDREN WITH SEVER'S DISEASE

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ABSTRACT

Background. Sever's disease is a common cause of heel and ankle pain among children, often linked to excessive sports participation, inappropriate footwear, lack of flexibility, muscle weakness, and excess body weight. Rehabilitation interventions, including magnetic therapy and structured exercises, have shown promise in addressing musculoskeletal disorders; however, their effectiveness in treating Sever's disease remains underexplored. **Objectives.** This study aimed to evaluate the effect of magnetic therapy and rehabilitation exercises on improving selected physical and motor abilities and reducing pain in children with Sever's disease. **Method.** An experimental design was employed with a purposive sample of 17 children diagnosed with the condition. The intervention program consisted of 25 rehabilitation units delivered over five weeks, at a frequency of five sessions per week. Magnetic therapy sessions and rehabilitation exercises were developed based on pilot testing and subsequently applied to the study group. Pre- and post-tests were conducted to measure physical and motor abilities as well as pain reduction, and the results were analyzed statistically. **Results.** Findings demonstrated significant improvements in flexibility, strength, motor performance, and pain reduction among participants after the intervention. These outcomes highlight the therapeutic value of combining magnetic therapy with rehabilitation exercises for pediatric patients suffering from Sever's disease. **Conclusion.** The study concludes that such an integrative approach is effective for rehabilitation and may be extended to other joint-related conditions. The contribution of this research lies in providing empirical evidence supporting a non-invasive, safe, and accessible treatment protocol that can enhance the quality of life for children with musculoskeletal disorders.

Keywords; rehabilitation exercises, magnetic therapy, ankle joint, physical abilities, motor abilities, pain level.

A. INTRODUCTION

Sports have historically been regarded as an essential aspect of human life, contributing to physical health, social development, and cultural progress (Okilanda et al., 2023; Rubiyatno et al., 2023). In the modern era, sports sciences—particularly sports medicine and rehabilitation—have become increasingly important for addressing injuries that limit participation in both recreational and professional activities (Graha et al., 2023; Simplicio et al., 2024). Injuries can occur in individuals of all ages, but in children, certain musculoskeletal disorders are especially concerning due to their potential to disrupt growth and development (Suhartini et al., 2024). Among these, Sever's disease, also known as calcaneal apophysitis, is a notable condition that affects the heel and ankle, leading to pain and functional impairment.

Sever's disease is an overuse injury resulting from repetitive stress on the growth plate of the heel. It is particularly prevalent in physically active children and adolescents, typically between the ages of 8 and 12 years, during periods of rapid growth (James et al., 2013). Symptoms often include heel pain, swelling, and difficulty in walking or running, which can restrict participation in sports and daily activities. Epidemiological studies suggest that the condition is one of the most common causes of heel pain in children, with prevalence estimates ranging from 2% to 16% among active populations (Micheli & Ireland, 1987). Despite its frequency, treatment approaches vary widely, and many cases rely on rest, pain medication, or general physical therapy.

The increasing involvement of children in organized sports has led to a noticeable rise in musculoskeletal injuries, making it essential to develop effective, non-invasive, and child-appropriate rehabilitation methods (Jurek et al., 2024; Abu et al., 2003). Conventional treatments for Sever's disease often focus on rest and stretching, yet they may not adequately restore physical and motor abilities or prevent recurrence (Al-Obaidi, N., & Al-Maliki, F. 2008; Tawfiq, A. 2019). This gap highlights the need for innovative interventions that not only alleviate pain but also enhance muscular strength, flexibility, balance, and coordination. Rehabilitation exercises have proven effective in restoring function after musculoskeletal injuries by addressing weaknesses and improving movement quality (James et al., 2013).

Magnetic therapy has recently emerged as a complementary treatment in rehabilitation medicine. Research suggests that magnetic fields may improve circulation, reduce inflammation, and accelerate tissue repair, thereby contributing to pain reduction and functional recovery (Micheli & Ireland, 1987). While magnetic therapy has been explored in adults for conditions such as osteoarthritis and tendinopathies, its application in pediatric populations—particularly for Sever's disease—remains limited. Combining rehabilitation exercises with magnetic therapy may provide a novel, integrative approach to managing heel injuries in children (James et al., 2013).

The novelty of this research lies in its experimental investigation of the combined effects of magnetic therapy and rehabilitation exercises on children with Sever's disease. Unlike previous studies that evaluated these treatments separately, this study assesses their synergistic impact on both physical and motor abilities as well as pain reduction. By focusing on a pediatric sample, the research addresses a critical gap in the literature and provides practical recommendations for sports medicine specialists, physical therapists, and coaches.

Thus, this study not only seeks to confirm the effectiveness of an integrative treatment protocol but also aims to expand the understanding of non-invasive therapeutic strategies for children with musculoskeletal disorders. Ultimately, the findings are expected to contribute to safer rehabilitation practices, improved quality of life for affected children, and reduced reliance on pharmacological treatments that may carry side effects.

B. METHOD

Participant

The research sample consisted of children diagnosed with Sever's disease who were active in sports and attended the Ibrahim Al-Asheq Center and Al-Shifa Physiotherapy Clinic in Sadr City. Initially, 20 children with similar injury duration and diagnosis on the right foot were identified. After excluding three participants who took part in pilot experiments, the final sample comprised 17 children (aged 10–13 years). Homogeneity was confirmed in terms of age, weight, height, and duration of injury, ensuring comparability among participants.

Table 1. Descriptive statistics and homogeneity of participants (N = 17)

Variable	Unit	M	Mdn	SD	Skewness
Weight	Kg	43.53	44	1.07	0.61
Height	Cm	129.29	133	6.00	0.62
Age	Years	12.18	12	0.88	0.99
Duration of injury	Month	1.29	1	0.47	0.99

Research Design

An experimental design with pre- and post-tests was employed to examine the effects of magnetic therapy and rehabilitation exercises on selected physical and motor abilities as well as pain reduction. The experimental method was chosen because it enables rigorous testing of cause-and-effect relationships and provides reliable scientific evidence (Rateb & Alawi, 2017).

Procedure

Two pilot experiments were first conducted to test the research instruments, rehabilitation exercises, and magnetic therapy sessions. The first pilot, held on October 28, 2024, tested the measurement procedures, while the second, on October 29, 2024, tested the intervention program. Three participants took part in the pilot studies and were later excluded from the main sample.

Pre-tests were administered from November 3 to 6, 2024, under standardized conditions. The main experiment ran from November 10 to December 26, 2024, comprising 25 treatment sessions delivered over five weeks (five sessions per week). Each session began with magnetic therapy, aimed at reducing pain and enhancing circulation, followed by rehabilitation exercises with progressively increasing repetitions (starting from three per exercise, increasing by two each week). Sessions lasted for variable durations depending on progression, and Friday and Saturday were rest days. Post-tests were conducted from January 5 to 8, 2025, under the same conditions as the pre-tests.

Table 2. Validity, reliability, and objectivity of research tests

Variable	Validity	Reliability	Objectivity
Lateral ankle flexion strength	0.96	0.93	0.92
Medial ankle flexion strength	0.95	0.90	0.92
Speed	0.95	0.91	0.90
Ankle plantar flexion	0.94	0.89	0.91
Ankle dorsiflexion	0.96	0.92	0.91
Balance	0.95	0.91	0.88
Coordination	0.93	0.87	0.90
Pain score	0.97	0.95	0.94

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS). The following statistical techniques were applied: arithmetic mean, standard deviation, median, Pearson correlation coefficient, skewness coefficient, and paired t-test. These analyses were used to examine homogeneity, test validity and reliability, and identify significant differences between pre- and post-tests in physical abilities, motor abilities, and pain levels.

C. RESULTS AND DISCUSSION

Results

Table 3 presents the pre- and post-test results for physical abilities, including lateral ankle flexion strength, medial ankle flexion strength, and speed. The results show significant improvements across all three variables in favor of the post-tests at $p \leq 0.001$. Specifically, lateral ankle flexion strength increased from a mean of 18.41 (SD = 1.33) in the pre-test to 27.94 (SD = 0.75) in the post-test, with a calculated *t* value of 22.17. Similarly, medial ankle flexion strength improved from 21.18 (SD = 1.24) to 30.24 (SD = 1.48), with a *t* value of 18.54. Speed performance also showed a marked improvement, where the mean decreased from 21.59 (SD = 1.12) to 14.06 (SD = 0.83), reflecting faster movement time, with a *t* value of 19.11. These results indicate that the rehabilitation exercises and magnetic therapy effectively enhanced strength and speed in the affected joints.

Table 3. Physical Ability Tests

Sig.	T-test	Post-test		Pre-test		Variables
		St.d	Mean	St.d	Mean	
0.001	22.174	0.747	27.941	1.325	18.411	Measuring lateral ankle flexion strength
0.001	18.539	1.48	30.235	1.236	21.176	Measuring medial ankle flexion strength
0.001	19.108	0.826	14.058	1.121	21.588	Speed

Table 4. Motor Ability Tests

Sig.	T-*test*	Post-test		Pre-test		Variables
		St.d	Mean	St.d	Mean	
0.001	27.132	0.928	17.117	0.927	8.882	Ankle plantar flexion measurement
0.001	64.024	1.124	46.529	1.088	21.941	Ankle dorsiflexion measurement

0.001	31.005	0.899	13.941	0.808	6.176	Balance
0.001	28.264	0.227	3.073	0.105	1.535	Coordination

Table 4 demonstrates significant improvements in motor abilities, namely ankle plantar flexion, ankle dorsiflexion, balance, and coordination, all at $p \leq 0.001$. The mean score for plantar flexion increased from 8.88 (SD = 0.93) in the pre-test to 17.12 (SD = 0.93) in the post-test, with a *t* value of 27.13. Dorsiflexion improved from 21.94 (SD = 1.09) to 46.53 (SD = 1.12), showing a large difference confirmed by a *t* value of 64.02. Balance scores improved from 6.18 (SD = 0.81) to 13.94 (SD = 0.90), with a *t* value of 31.01. Coordination showed the most notable improvement, increasing from 1.54 (SD = 0.11) to 3.07 (SD = 0.23), with a *t* value of 28.26. These results highlight the program's effectiveness in improving neuromuscular control, flexibility, and stability in children with Sever's disease.

Table 5. Pain Scores

Sig.	T-*test*	Post-test		Pre-test		Variables
		St.d	Mean	St.d	Mean	
0.001	25.483	0.712	1.588	0.808	9.176	Pain score

Table 5 reports the effect of the intervention on pain levels. The results indicate a significant reduction in pain, with pre-test scores averaging 9.18 (SD = 0.81) compared to post-test scores averaging 1.59 (SD = 0.71). The large improvement was statistically significant, with a *t* value of 25.48 at $p \leq 0.001$. This demonstrates that the combined use of magnetic therapy and rehabilitation exercises not only improved physical and motor abilities but also substantially reduced pain levels among participants.

Discussion

The results of this study demonstrated significant improvements in physical abilities (lateral and medial ankle flexion strength, and speed), motor abilities (plantar and dorsiflexion, balance, and coordination), and pain reduction following the application of magnetic therapy combined with rehabilitation exercises. These findings confirm the first hypothesis, which proposed that there would be statistically significant differences between the pre- and post-tests in favor of the post-tests.

The increase in ankle flexion strength and leg speed can be attributed to the progressive rehabilitation program that emphasized gradual overload and functional exercises. These

results are consistent with Al-Zubaidi et al. (2016), who emphasized that rehabilitation exercises restore flexibility, muscular strength, and range of motion, thereby preventing reinjury. Similar outcomes were reported by Agustina et al., (2024), who found that progressive resistance training enhances neuromuscular function and speed among youth athletes. On the other hand, some studies have suggested that rest alone is sufficient for recovery from Sever's disease (James et al., 2013). However, the current findings contradict this by showing that active rehabilitation combined with magnetic therapy achieves superior functional recovery in less time (Apers et al., 2021).

Post-test improvements in plantar flexion, dorsiflexion, balance, and coordination highlight the direct effect of targeted rehabilitation and magnetic therapy in restoring joint mechanics and neuromuscular coordination. El-Ashry (2018) reported that joint flexibility and neuromuscular balance are key determinants of coordination in children, supporting the results of this study. Likewise, Rismayanthi et al., (2024) found that exercise-based interventions in pediatric injuries significantly improve balance and coordination. However, some scholars argue that magnetic therapy lacks sufficient empirical support (Suryadi et al., 2024). The present findings provide evidence in favor of its use, particularly when combined with exercise, suggesting a synergistic effect.

Pain scores decreased significantly after the intervention, supporting the therapeutic value of magnetic therapy. These findings align with Khalil (2010), who reported that magnetic fields enhance circulation, accelerate cell regeneration, and reduce nerve excitability, leading to pain relief. Similar results have been reported in studies on adults with musculoskeletal pain (Micheli & Ireland, 1987). Nevertheless, some systematic reviews Hernandez-Lucas et al., (2024), have questioned the clinical effectiveness of magnetic therapy, citing inconsistent results across trials. The current study provides encouraging evidence in a pediatric population, although further replication with larger samples is needed.

Despite these positive results, the study has limitations. First, the small sample size (N = 17) limits the generalizability of the findings, and the absence of a control group restricts causal inferences regarding magnetic therapy versus rehabilitation exercises alone. Second, the short duration of the intervention (five weeks) does not allow for long-term follow-up to

determine whether improvements are maintained over time. Third, the study relied primarily on functional and subjective assessments without incorporating advanced imaging or biochemical markers, which could provide more objective evidence of healing processes. Finally, as the sample was recruited from a single geographic area, cultural and environmental factors may have influenced the outcomes.

Despite these limitations, the study contributes to the growing body of literature by being among the first to experimentally evaluate the combined use of magnetic therapy and rehabilitation exercises in children with Sever's disease. The findings suggest that integrative, non-invasive interventions can enhance recovery outcomes beyond traditional treatment methods. This provides valuable insights for clinicians, physiotherapists, and sports coaches seeking to optimize rehabilitation protocols for pediatric musculoskeletal injuries.

D. CONCLUSION

Based on the findings of this study, it can be concluded that magnetic therapy sessions combined with rehabilitation exercises had a positive effect on children with Sever's disease, as evidenced by improvements in joint flexibility, ankle muscle strength, and significant reductions in pain levels. The number of sessions, the structure of the rehabilitation units, and the scheduling of exercise days were appropriate for the sample, producing favorable outcomes in both physical and motor abilities. The planned rest periods also contributed effectively to recovery and performance gains. Accordingly, it is recommended that magnetic therapy and rehabilitation exercises be utilized in the treatment and rehabilitation of other musculoskeletal injuries, with the number of units tailored to the specific condition. Future programs for Sever's disease should explore the integration of additional therapeutic methods and exercise protocols, while also considering individual differences such as age, gender, type, and duration of injury in program design.

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F. AUTHOR CONTRIBUTION STATEMENT

Amal Dawood Abd-Alhasan contributed fully to all stages of the research, from formulating the research idea, designing the methodology, collecting and analyzing data, to writing the final manuscript. The author ensures the authenticity of this research and is fully responsible for the content, findings, and recommendations presented.

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