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Bethany Hyde
Governors State University

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**EFFECTIVENESS OF CONSERVATIVE PHYSICAL THERAPY ON A 17
YEAR OLD FEMALE DIAGNOSED WITH LEGG-CALVE-PERTHES
DISEASE**

By

Bethany Hyde
B.S., Olivet Nazarene University

Capstone

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For the Degree of Doctor of Physical Therapy

Governors State University
University Park, IL 60484

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EFFECTIVENESS OF CONSERVATIVE PHYSICAL THERAPY ON A 17 YEAR OLD FEMALE DIAGNOSED WITH LEGG- CALVE-PERTHES DISEASE

ABSTRACT

Background & Purpose: There is currently a lack of research for physical therapy as an intervention in the treatment of Legg-Calve-Perthes Disease. The purpose of this case report is to explore the effectiveness of conservative physical therapy intervention for a 17-year-old female diagnosed with Legg-Calve-Perthes Disease.

Case Description: This case report includes the examination, evaluation, and treatment of a patient with Legg-Calve-Perthes Disease. Interventions focused on increasing strength and range of motion of the left lower extremity, improving balance and proprioception, and the incorporation of functional activities. To measure the effectiveness of the intervention the following examinations were used: Lower Extremity Functional Scale (LEFS) to evaluate the effects of the disease on the patient's function, Classification Instrument in Perthes (CLIPer) to assess the involvement (mild, moderate or severe), Numerical Rating Pain Score (NRPS) to assess the level of pain, Manual Muscle Testing to assess strength and Goniometry to measure range of motion.

Outcomes: After a total of 14 visits over 9 weeks, the patient demonstrated improved range of motion for hip flexion, abduction, internal and external rotation for the involved leg. Strength of the involved lower extremity also improved for all muscle groups tested. Other noted improvements included improved balance and decreased reliance on an assistive device. The patient made progress towards each of her goals, but did not fully meet any of them. She also indicated an increase in pain over the course of this study that limited her functional abilities.

Discussion: The results of this study confirm the findings of previous literature and make the case for physical therapy as an effective means of conservative management of Legg-Calve-Perthes Disease. This study also serves as an example of the clinical implementation of the principles found in *Evidence-Based Care Guidelines for Conservative Management of Legg-Calve-Perthes Disease*. Future research should investigate the effectiveness of other modes of physical therapy such as aquatic therapy, the use of physical agents, as well as using physical therapy in combination with the use of an orthotic device.

INTRODUCTION

Legg-Calve-Perthes Disease (LCP) is a condition in which the blood flow to the femoral epiphysis is interrupted resulting in idiopathic osteonecrosis of the femoral head. With typical onset in children ages 4 to 8, this disease causes a change in the growth of the proximal femur and is often associated with a flattening of the femoral head. This flattening decreases the congruence between the femur and the articulating acetabulum, which often leads to subluxation of the femur. ¹ The head of the femur is laterally displaced and often rests inappropriately on the rim of the acetabulum. Displacement can cause further changes to the young bony tissue in which the epiphysis is not fully fused.²

Incidence of this disease is reported to be 0.2-19.1 out of 100,000 children with the greatest prevalence being among Caucasian, South and Eastern Asian populations. Geographic analysis also revealed for every 10 degrees increased in latitude, the incidence of LCP increased by a factor of 2.35.² LCP is also 4 times more likely to occur in males than females. ¹

Due to the rarity of this disease,² the body of research is limited. The cause of this disease remains unknown.³ A 2006 study by Brech *et al.* claims to be the first to look at effectiveness of physical therapy as a treatment of LCP. This study compared range of motion and strength of patients who received 12 weeks of physical therapy to a control group and concluded that the group that received physical therapy demonstrated marked improvements not seen in the control group.⁴ A 2012 literature review in

Advances in Orthopedics compared surgical and non-surgical treatment approaches for LCP; however, physical therapy was not included as a non-surgical intervention, nor is it mentioned in the article.³ A study done by Mazloui *et. al* in 2014 mentions the importance of physical therapy, but also does not include it as a conservative treatment method for patient with LCP.⁵ Instead, both studies compare the outcomes of LCP patients treated with orthotic devices to those treated with surgical intervention.^{4,5}

In 2011, the Cincinnati Children's Hospital Medical Center published a guide entitled *Evidence-Based Care Guideline for Conservative Management of Legg-Calve-Perthes Disease*. This publication is the attempt of many health care professionals to create a guide for treating a condition for which there is currently little research. This guideline and its associated outcome measure, the Classification Instrument in Perthes (CLIPer), served as the primary resource for this case report and was the primary document that informed decisions related to the plan of care for this patient.⁶

The purpose of this case report was to examine the effectiveness of conservative physical therapy treatment program for a 17-year-old female referred to physical therapy following a diagnosis of Legg-Calve-Perthes Disease. The treatments used in this study focused on strengthening, range of motion, balance, functional activities, and improved quality of life.

CASE DESCRIPTION: PATIENT HISTORY & SYSTEMS REVIEW

The patient was a 17-year-old female who began experiencing left hip pain in November/December of 2013 that progressively worsened. In April of 2014, after multiple radiographs and MRIs, she received the medical diagnosis of Legg-Calve-Perthes Disease (LCP) of the left hip. She was referred to outpatient physical therapy and began treatment in August of 2014.

The patient was a senior in high school, who attended school 5 days a week and worked part time at a library on the weekends. Upon evaluation, she reported using crutches to ambulate long distances, but did not use an assistive device for household distances. She also reported difficulty ambulating stairs at home, work and school and had increased pain with prolonged sitting or standing (more than 30 minutes). She reported functional limitations with driving, transferring into and out of the car, grooming and self care activities, donning and doffing pants, shoes and socks, and standing up from a chair.

Significant findings of the patient's medical history include a surgery to remove a pilondil cyst and a subsequent procedure to remove scar tissue from the same area. She was prescribed 75mg of Voltaren to control pain and inflammation in the hip joint by her physician which she reported taking as instructed. At no point prior to or during this study, did the patient use an orthosis. An orthosis was not used because the physician favored physical therapy intervention prior exploring other intervention options.

Upon observation in standing, the patient presented with an anterior pelvic tilt, left leg postured in internal rotation, anteversion of the left femur and bilateral pes planus of the feet. Review of the musculoskeletal system revealed decreased left hip range of motion and strength, decreased hamstring length, and leg length discrepancies. Neuromuscular system review indicated impaired balance on the left leg measured using a timed single leg stance test. During the functional assessment, the patient was able to ascend and descend a 6-inch step for six repetitions with reports of pain and instability in the left hip. A visual gait assessment revealed extreme internal rotation of the bilateral lower extremities during ambulation.

CLINICAL IMPRESSION

This patient is appropriate for a case report because there is a lack of research on physical therapy treatment for patients with LCP. The patient's age of disease onset also makes this case interesting because LCP onset is most common in children ages 4 to 8.¹ This patient is well outside of this age range, thus making her case unique. The examination of this patient consisted of various testing tools to quantify the impact of LCP on the patient's body structure and function and her ability to participate in the demands of her life⁷. Due to the physical therapist's lack of experience with treating this condition, the *Evidenced-Based Care Guidelines for Conservative Management of Legg-Calve-Perthes Disease* was heavily relied

upon for information including examination, outcome measures, goals and treatment of this condition. This resource provides the most comprehensive guide to the treatment of LCP in the literature today for a clinician focused on evidence-based practice.⁶

TESTS & MEASURES

Lower Extremity Functional Scale (LEFS)

The Lower Extremity Functional Scale was chosen as an outcome measure to evaluate the effect of LCP on the patient's function and performance of her daily activities. This self-report questionnaire asks the patient to rate the difficulty of various life activities in regards to their injury or disease on scale of 0-4 (with 0 being extremely difficult or unable to perform and 4 being no difficulty). This test has excellent test-retest reliability of 0.86 and excellent interrater reliability of 0.84 in patients with hip osteoarthritis.⁸ In order for an improvement to be considered clinically significant; the LEFS score must change by at least 9 points.⁸

Classification Instrument in Perthes (CLIPer)

The Classification Instrument in Perthes or CLIPer serves as a functional measure used to classify Perthes disease into stages based on the physical impairments of the patient. It incorporates pain, hip range of motion, hip strength, balance and gait. Based on these categories, the patient's score indicates mild, moderate or severe involvement. There is no psychometric

data available for the CLIPer to date, but it was chosen because it is the only test of its kind. This measure, developed in 2011 by a group of medical professionals from Cincinnati Children's Hospital Medical Center, accompanies a guide to conservative treatment based on the scores obtained using the CLIPer.⁶

Numerical Pain Rating Scale (NPRS)

This assessment involves asking the patient to give a numerical report of his or her pain on a scale from 0 to 10 (where 0= absence of pain and 10= the worst pain the patient could imagine). This test has adequate test-retest reliability (0.63) for patients with chronic pain.⁹ Criterion Validity was found to be excellent (0.88) in a 2004 study done in healthy populations.¹⁰

Manual Muscle Testing

Manual muscle testing is a method used by health care professionals to quantify the strength of a particular muscle or groups of muscles. Muscle strength is graded on a scale of 0 to 5 (where 0 indicates no muscle contraction and 5 indicates maximum muscle force production). Musculature of the lower extremity was tested for muscles and muscle groups determined to be important by the evaluating therapist. Specific techniques can be referenced in *Daniels & Worthingham's Muscle Testing: Techniques of Manual Examination*.¹¹ Test-retest reliability was found to be excellent (0.97) with specificity of 0.90 and sensitivity of 0.35 in a 2010 study of patients with osteoarthritis.¹²

Goniometry

Goniometry is a form of measurement used to assess the amount of motion (or range of motion) available in a given joint. Achieving full range of motion in a joint allows for efficient movement that decreases the risk for injury.

Intrarater reliability for goniometric measurements is reported to be 0.53 to 0.71.¹³ While statistics for goniometry are not remarkable, it is a measurement tool widely used and relied upon by physical therapist to measure joint range of motion.

Table 1: Baseline Finding & Post Treatment Results of LEFS, CLIPer & NPRS

	Initial Evaluation	Final Assessment
LEFS	23/80 31.25%	27/80 35.0%
CLIPer	11 (Moderate Involvement)	5 (Mild Involvement)
NPRS	0/10	7/10

Table 2: Baseline Findings & Post Treatment Results for Muscle Strength

Initial	Final
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	Evaluation		Assessment	
	Right	Left	Right	Left
Hip Flexion	4+	3-	4+	4-
Hip Abduction	4+	3	4+	4
Hip External Rotation	4+	3	4+	4-
Knee Flexion	4+	3+	4+	4+
Knee Extension	4+	3+	4+	4+
Dorsiflexion	5	3+	5	4+

Table 3: Baseline Findings & Post Treatment Results for Range of Motion (left limb affected)

	Initial Evaluation		Final Assessment	
	Right	Left	Right	Left
Hip Flexion	90°	75°	100°	95°
Hip Abduction	30°	18°	45°	38°
Hip External Rotation	Not Tested	Unable to test	42°	30°
Hip Internal Rotation	Not Tested	Unable to test	46°	40°
Knee Flexion	132°	125°	132°	125°

DIAGNOSIS

The patient demonstrated decreased left hip range of motion and strength, impaired balance, pain, and gait deviations. These impairments along with the patient's medical diagnosis suggest a physical therapy diagnosis of Musculoskeletal Practice Pattern 4D: Impaired Joint Mobility, Motor Function, Muscle Performance, and Range of Motion Associated With Connective Tissue Dysfunction.¹⁴

PROGNOSIS & GOALS

Literature reports a poor prognosis for those diagnosed with LCP after the age of 6.^{1,5} Thus a poor prognosis was established for this patient given her age of 17. The CLIPer score was used to determine the focus of the interventions. The patient's symptoms indicated "Moderate Involvement" according to the CLIPer⁶ and a treatment plan was created that was consistent with that level of involvement. It was recommended that the patient attend 1-2 sessions a week for 8-12 weeks⁶. The physical therapist and the patient, along with her family, made the decision to alternate number of visits per week (1 visit in a week followed by 2 visits the subsequent week). The treatments sessions lasted for 1 hour in order to achieve the goals established by the physical therapist and the patient. Long-term goals to be met in 12 weeks were for the patient to be able to perform the following activities without limitation: driving, transfer in and out of the car, groom and complete self care, ascend and descend stairs

without using the handrail, transfer into and out of the shower, put on socks and shoes, and get into and out of chair. Goals focused on functional activities that most impacted the patient's daily life.

INTERVENTION PROCEDURES

The patient attended physical therapy 1-2 times a week for 9 weeks for a total of 14 visits. Each session lasted approximately one hour. Interventions focused on improving range of motion and strength of the left lower extremity, improving balance and proprioception, and incorporation of functional activities.⁶ Interventions were selected based on patient's current level of function, pain, activity tolerance and support in the research.⁶ Specific exercises and progressions for the 9-week treatment are listed in Appendix A. The patient was also provided with a home exercise program to be performed on days in which the patient did not attend physical therapy in order to maintain gains between therapy visits. The home exercise program included heel slides, posterior pelvic tilts and supine hip external rotation exercises.

Beginning in the fifth week of treatment, the patient began describing what she labeled a "flare up", something she had never experienced before. A "flare up" consisted of intense pain that limited the patient from ambulating thus limiting her ability to attend school and work. Symptoms typically lasted for 24 to 48 hours. "Flare ups" were reportedly caused by

“moving [left hip] wrong”, “moving too quickly” or without the presence of an apparent cause. These typically occurred about once a week starting in the fifth week of treatment. Towards the end of treatment long axis distraction was applied to the left leg. The patient was positioned in supine with the left leg abducted and slightly flexed for this intervention. Distraction was applied to the left leg by grasping at the ankle and pulling in an inferior direction. The patient reported decreased left hip pain with this intervention. In between physical therapy treatments, the patient was able to use this technique (with the assistance of a parent) during a “flare up”. She reported a “flare up” duration of only 6 hours after applying this intervention. Previously “flare ups” lasted 24 to 48 hours.

After 9 weeks of therapy, the patient returned to her physician and was prescribed 3 more weeks of outpatient physical therapy before exploring other medical interventions that would provide further pain relief.

OUTCOMES

At the conclusion of this 9 week study, the patient demonstrated improved strength of all muscles groups tested at initial evaluation (See Table 2). She also demonstrated improved range of motion for left hip flexion, abduction, external rotation and internal rotation (See Table 3). Balance improved with equal single leg stance time bilaterally. The patient was able to stand on either leg for at least 30 seconds. On the CLIPer, the

patient improved from moderate involvement at initial evaluation to mild involvement after 9 weeks of physical therapy. Despite these documented improvements, formal assessments revealed little increase in the patient's functional abilities. Progress was made towards each goal set at the beginning of treatment, but the patient did not fully meet any of the goals. The patient's LEFS score also showed minimal improvement that is not considered clinically significant.⁸ She also demonstrated a significant increase in pain since beginning physical therapy with the NPRS increasing from 0/10 at initial evaluation to 7/10 at final evaluation. The patient stated that she noticed improved strength, range of motion and balance in her left hip. She also reported no longer needing an assistive device for long distance ambulation and being able to run approximately 300 feet without lasting symptoms. The patient returned to her physician after 9 weeks of physical therapy and together they decided to continue with 3 more weeks of therapy before exploring further medical intervention.

DISCUSSION

The purpose of this case report was to examine the effectiveness of a conservative physical therapy treatment program for an adolescent referred to physical therapy following a diagnosis of Legg-Calve-Perthes Disease. The treatments utilized in this report focused on improving strength, range of motion, balance, ability to participate in functional activities and improving

overall quality of life. This case report is significant because it demonstrates the effects of physical therapy intervention for LCP used prior to or as an alternative to surgery and other forms of conservative management. This case report also demonstrates the utilization of the *Evidence-Based Care Guidelines for Conservative Management of Legg-Calve-Perthes Disease* as a guide for clinical practice.

The study by Brech *et al.* clinically evaluated the effectiveness of physical therapy for patients with LCP. A combination of stretching, therapeutic exercise, and balance training was used for patient with LCP. They concluded that patients who did receive physical therapy intervention showed improved range of motion and strength in the affected hip.⁴ This case report used similar interventions and it confirms those findings while also demonstrating improvements in balance. Unlike Brech *et al.*, however, this study chose to look at functional outcome measures in conjunction with measurements of strength and range of motion in order to assess the impact physical therapy intervention functionally (as seen in Table 1). A 2012 study in *Advances in Orthopedics* compared surgical versus non-surgical treatment approaches for LCP, but chose not to include physical therapy as a non-surgical option. They concluded that effectiveness of the treatments was conflicting at best and even noted that some evidence suggested that no treatment is potentially as effective as surgery or orthotic intervention.³ Mazloumi *et al.* mentioned physical therapy as an important intervention for

LCP, but also did not include it in their consideration of conservative management.⁵ Due to the limited body of research, this case report used *Evidence-Based Care Guideline for Conservative Management of Legg-Calve-Perthes Disease* published by the Cincinnati Children's Hospital Medical Center in 2011 as a primary resource. This case report utilized the CLIPer assessment to stage the patient's disease in order to determine the focus of the intervention.⁶ No research has come to the author's attention that has implemented this Guideline in clinical practice.

While the patient in this case report did make significant gains in strength, range of motion and balance of the affected lower extremity, she reported an increase in pain since beginning physical therapy intervention and her LEFS score did not demonstrate an increase in function that was clinically significant.⁴ She indicated that the increase in pain was the primary factor limiting her functional abilities. While the reason for this increase in pain is not clear, a change in the disease process or potential bony fragmentation could serve as an explanation⁶. Pain control was not a significant focus of this study because upon initial evaluation the patient did not report pain to be a primary limitation. Future studies should look at various pain control methods to allow patients to participate in functional activities without pain.

To the knowledge of the author of this case report, no prior literature documents the incidence of "flare ups" experienced by the patient in this

report or intervention to decrease the duration of “flare up” symptoms. This study also describes the incidence of LCP in a patient well outside of the typical age range for diagnosis with this disease. It is reported that the prognosis for those diagnosed with LCP after the age of 6 is poor^{1,5}. Despite her diagnosis at age 17, this patient was able to make significant gains after only 9 weeks of physical therapy.

Future research is needed to determine best practices for physical therapy intervention for patients with LCP including treatment frequency and duration. Other modes of intervention should also be explored. This study relied heavily on standard therapeutic exercise in an outpatient clinic. Future research should explore the effects of aquatic therapy, other manual techniques and the use of physical agents. A study of the effectiveness of physical therapy intervention in combination with the use of an orthotic device would also be beneficial. Further study of the CLIPer assessment is also needed to determine validity and reliability.

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Appendix A: EXERCISE LOG

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14
Hip AROM External Rotation in Supine	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bridges in Supine	X	X	X	X	X	X	X	X	X	X	X			
Bridge with Leg Lift												X	X	X
Supine Marching	X	X	X		X	X	X	X	X	X	X	X	X	X
Supine Straight Leg Raise								X	X	X	X	X	X	X
Hip Abduction in Side-lying	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hip Internal Rotation in side-lying							X	X	X	X	X	X	X	X
Clams in Side-lying	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ankle ROM with Resistance Band	X	X	X	X	X	X	X	X	X	X	X	X	X	
Stationary Bike	X	X	X		X	X	X	X	X	X	X	X	X	X
Total Gym Squat	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weight Shift (Forward/Backward & Side/Side)	X	X	X	X	X									
4" Step up & over	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Step up& over on BOSU						X	X	X	X	X	X	X	X	X
Side Steps	X													
Side Steps with Resistance Band		X	X		X	X	X	X	X	X	X	X	X	X
Standing Hip Flexion, Abduction & Extension	X	X	X		X	X	X	X	X	X	X			

Standing Hip Flexion, Abduction & Extension with Resistance Band													X	X	X
Standing Terminal Knee Extension with Resistance Band		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hip AAROM External & Internal Rotation in Standing (with knee bent and lower leg resting on stool)						X	X	X	X	X	X	X	X	X	X
Slideboard Hip Extension & Abduction									X	X	X	X	X	X	X
Foam Pad Double Leg Stance	X	X													
Foam Pad Double Leg Stance while throwing ball at rebounder			X		X	X	X	X	X	X	X	X	X	X	X
Single Leg Stance															X
Sitting Hamstring Stretch	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Long Axis Hip Distraction														X	X
Hip PROM	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

*V# represent the visit number, with a total of 14 visits in the Episode of Care.

