Anderson Center for Health Systems Excellence

Evidence-Based Care Guideline

Conservative Management of Legg-Calve-Perthes Disease

In children aged 3 to 12 years[a]

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Target Population

Inclusions:

- Children with diagnosis of Legg-Calve-Perthes disease (LCP) in disease stages 1-3
  - Stage 1: Femoral head becomes more dense with possible fracture of supporting bone;
  - Stage 2: Fragmentation and reabsorption of bone;
  - Stage 3: Reossification when new bone has regrown.
- Children ages 3-12 years old

Exclusions:

- Children with the following:
  - Post-operative for LCP
  - Other diagnosis of avascular necrosis in hip
  - Femoral head injury or fracture
  - Slipped capital femoral epiphysis
  - Femur fracture
  - Acetabular or pelvis fracture
  - LCP present with other hip condition
  - Acetabular labral tear
  - Cancer or bone tumor in femur
  - Arthritis in hip
  - Hip dysplasia
  - Cerebral palsy

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Target Users

Include but are not limited to (in alphabetical order):

- Athletic Trainers
- Community-based caregivers (e.g. physical education teachers, school personnel)
- Nurses
- Patients and families
- Physical Therapist Assistants
- Physical Therapists
- Primary care providers

Introduction

References in parentheses ( ) Evidence level in [ ] (See last page for definitions)

LCP disease progresses through four stages as seen on radiographs using Modified Waldenstrom Classification. The duration of each stage varies.

Stage 1-Initial Stage

The capital epiphysis of the femoral head stops growing, causing a smaller ossific nucleus. Waldentrom's sign, or a fracture in the subchondral area of the femoral head, can be seen on frog leg radiographs in this stage. The femoral head appears to be denser. There are cysts and lucencies in the metaphysis that can also be seen on radiographs. The initial stage ends when the lucencies are in the ossific nucleus. Mean duration of this stage is 6 months *(Herring 2001 [5])*.

Stage 2-Fragmentation Stage

Some areas of the femoral head are sclerotic, while lucencies remain in other areas. A central area of the femoral head separates from the medial and lateral portions. The acetabulum also becomes more irregular. The end of this stage occurs when new bone begins to develop in the subchondral areas of the femoral head. Mean duration of this stage is 8 months *(Herring 2001 [5])*.

Stage 3-Rossification Stage

Healing of the femoral head begins. New subchondral bone develops in the head of the femur, beginning in the center and extending out. The last area to reossify is often the anterior segment of the femoral head. Eventually the femoral head is replaced with woven bone, which then remodels to trabecular bone. The flattening of the femoral head may improve. This stage ends when the entire head has reossified and is typically the longest of the four, with a mean duration of 51 months *(Herring 2001 [5])*.

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Stage 4-Residual Stage

There are no changes in the density of the bone, but the shape of the femoral head can change during this phase. The final shape of the femoral head is developed once skeletal growth is complete. The femoral head may vary widely in shape, from normal to flat, at the conclusion of this stage. The acetabulum can also change in shape during this stage. Overgrowth of the greater trochanter can occur due to disruption of growth in the capital physis *(Herring 2001 [5])*.

Several orthopedic classification systems to describe the extent of the disease have been developed. The Catterall system consists of 4 groups classified based on the extent of involvement of the femoral head on radiographs *(Wenger 1991 [5a])*. The Salter-Thompson system classifies children into 2 groups based on the extent of subchondral fracture and amount of lateral margin of the femoral epiphysis *(Wenger 1991 [5a])*. Herring describes classification based on the involvement of the lateral pillar of the femoral head on radiographs *(Herring 2004 [4b])*.

The goal of treatment of children with LCP is to contain the femoral head in the acetabulum to maximize a spherical shape of the femoral head for good joint congruency *(Leach 2006 [5], Wenger 1991 [5a])*. However, there has been lack of agreement in treatment interventions in children with LCP to achieve this goal *(Weinstein 1997 [5a])*. Treatment has ranged from observation only, performing range of motion (ROM) exercises, use of Petrie casts, use of braces, and surgical intervention *(Leach 2006 [5], Wenger 1991 [5a])*. Evidence in the literature has been mixed regarding the success of conservative treatment only or surgical intervention *(Brech 2006 [3b], Herring 2004 [3b], Canavese 2008 [4b])*. Furthermore, there is limited evidence supporting a treatment pathway or methods in conservative management of LCP.

The objectives of this guideline are to:

- Guide and support consistency in delivery of physical therapy services for conservative management of patients with LCP
- Promote and optimize range of motion, strength, and joint preservation to minimize impairments and maximize function
- Maintain and improve patient and family satisfaction

Etiology

LCP affects children 3 to 12 years old and is most common in children 5 to 7 years old *(Leach 2006 [5], Wenger 1991 [5a])*. Males are affected 3 to 5 times more than females. There is bilateral hip involvement in 10% to 20% of cases *(Wenger 1991 [5a])*. Children with LCP disease typically present with a limp, which is a combination of an antalgic and a Trendelenburg type gait pattern. Pain is often present in the hip or referred to the thigh or knee *(Tamai 2004 [5])* . Limp and pain are commonly made worse with strenuous activities *(Tamai 2004 [5])* . Range of motion of the hip is limited, with the greatest limitations typically in hip abduction and internal rotation *(Tamai 2004 [5], Wenger 1991 [5a])*.

The disease process involves avascular necrosis of the femoral head due to a loss of blood supply *(Leach 2006 [5])*. As a result, growth is disturbed in the epiphyseal and physeal plates, resulting in premature closure. This can lead to a shortened femoral neck and trochanteric overgrowth. There is an asymmetric repair process causing deformity in the femoral head. The deformed femoral head then leads to a deformed acetabulum, especially the lateral aspect *(Weinstein 1997 [5a])*. The etiology of the disease is unclear, but one theory is there is onset of the disease following an episode of transient synovitis of the hip *(Leach 2006 [5], Wenger 1991 [5a])*. Children who present with LCP are typically small for their age and have delayed bone age *(Leach 2006 [5], Weinstein 1997 [5a], Wenger 1991 [5a])*. Maintaining the femoral head in the acetabulum during the repair process should yield a more spherical femoral head and overall a more congruous joint *(Wenger 1991 [5a])*.

Prognosis

Prognosis of the disease has been determined using several criteria, including age of onset of the disease *(Leach 2006 [5], Weinstein 1997 [5a], Wenger 1991 [5a])*, extent of involvement of the femoral head *(Leach 2006 [5], Wenger 1991 [5a])* , amount of incongruity between the femoral head and acetabulum *(Leach 2006 [5])*, and amount of hip joint deformity *(Weinstein 1997 [5a])*. Onset at a young age, minimal epiphyseal involvement, and short duration of the disease are favorable prognostic factors. Onset at an older age, greater epiphyseal involvement, lateral subluxation of the femoral head, and longer duration of the disease make up some of the poor prognostic factors *(Tamai 2004 [5])*.

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Guideline Recommendations

Physical Therapy Assessment and Diagnosis

Clinical Assessment

1. It is recommended that a thorough history and examination be completed to establish an impairment based physical therapy diagnosis and individualized plan of care *(APTA 2001 [5])*.

2. It is recommended that the following are assessed at the initial evaluation, on a monthly basis or sooner if the patient demonstrates a change in status, and at discharge *(Local Consensus [5])*:
   - Pain and symptoms
   - Lower extremity (LE) passive range of motion (PROM) and active range of motion (AROM)
   - Lower extremity strength
   - Gait
   - Balance
   - Outcome measures

Pain and symptoms

3. It is recommended that pain is assessed using the Oucher pain scale *(Beyer 2005 [4a])* or Numerical Rating Scale (NRS) *(Williamson 2005 [1b], von Baeyer 2009 [4b])*.

Lower extremity PROM and AROM

4. It is recommended that a fluid filled goniometer be used to measure ROM *(Rao 2001 [4b])*. Hip motions to assess include hip flexion, abduction, extension, internal rotation, external rotation.

   Note 1: Use of a linear goniometer is also acceptable based on availability in the clinic *(Rao 2001 [4b], Clapper 1988 [4b], Local Consensus [5])*.

   Note 2: Children with LCP who have better covering of the femoral head in the acetabulum and a more normalized acetabular shape will have greater hip abduction range of motion *(Grzegorzewski 2006 [4b])*.

5. It is recommended that knee and ankle range of motion be assessed at the initial evaluation and thereafter if they are significantly limited.

Lower extremity strength

6. It is recommended that quantitative muscle testing is performed using a hand held dynamometer due to its high intra- and inter-rater reliability *(Gajdosik 2005 [4b], Escolar 2001 [4b])*. Muscle groups to assess include hip flexors, hip abductors, hip extensors, hip internal rotators, hip external rotators, knee extensors, knee flexors, and any other muscle group that is significantly limited

Gait

7. It is recommended that gait be qualitatively assessed for common LCP deviations. Commonly observed gait characteristics seen in children with LCP include, but are not limited to:
   - increased hip adduction on stance leg *(Westhoff 2006 [4b])*,
   - trunk lean outside the normal range *(Westhoff 2006 [4b])*,
   - trendelenburg *(Westhoff 2006 [4b])* (hip drop on unaffected limb while in swing),
   - compensated trendelenburg/reverse trendelenburg/Duchenne *(Westhoff 2006 [4b])* (trunk lean to the affected side while in stance on the affected limb),
   - toe in or toe out *(Yoo 2008 [4b])*.

   Note 1: Based on limited accessibility and feasibility, the gold standard for gait analysis of 3-D gait kinematics and kinetics *(Toro 2003 [1b])* is not recommended to be used in the clinic *(Local Consensus [5])*.

   Note 2: There is insufficient evidence and lack of reliability and validity *(Toro 2003 [1b])* to support use of observational gait assessment tools with this population *(Local Consensus [5])*.

Balance

8. It is recommended that balance be assessed based on weight bearing status. The desired outcome is that the patient maintain balance for age appropriate times for safe ambulation and stair negotiation *(Local Consensus [5])*.

   Note: In patients 7 years or older, balance is to be assessed using the Pediatric Balance Scale *(Franjoine 2003 [4b])*. If the patient is younger than 7 years old, the test is unavailable, time does not permit its use, or the patient is unable to follow commands, balance is assessed using single leg stance on the involved side compared to the uninvolved side *(Local Consensus [5])*.

Outcome measure scores

9. It is recommended that the age appropriate Pediatric Quality of Life Inventory Version 4.0 (PedsQL) *(Varni 2001 [4a])*Physical Functioning section is administered at the initial evaluation, on a monthly basis for reassessment of patient's reported functional status, and at discharge *(Local Consensus [5])*.

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Note 1: The Parent Report for Toddlers is administered for children 2 to 4 years old *(Varni 2007a [4a])*.

Note 2: The Young Child Self Report is administered for children 5 to 7 years old *(Varni 2007a [4a])*.

Note 3: The Child Self Report is administered for children 8 to12 years old *(Varni 2007a [4a])*.

Note 4: For patients who are 5 to 12 years old and unable to conceptually understand the questionnaire tool, it is acceptable for the parent to complete the parent proxy form for the young child (age 5 to 7 years old) or child (age 8 to 12 years old *(Varni 2007b [4a])*.

Classification of Phases of Rehabilitation

10. It is recommended that the Classification Instrument in Perthes (CLIPer) be used to place the patient into a rehabilitation classification phase upon examination *(Local Consensus [5])* (See Appendix 1 for instructions and score sheet).

    Note 1: Conservative physical therapy treatment will be guided using the rehabilitation classification phases *(Local Consensus [5])*.

    Note 2: There are several orthopedic classification systems used to determine the stage and severity of the disease based on radiographic findings *(Herring 2004 [3b], Herring 2001 [5], Wenger 1991 [5a])*. In contrast, the CLIPer is a functional classification scale developed by the authors of this guideline. It is based on physical impairments (pain, ROM, strength, balance, and gait) and used to guide rehabilitation progression for this patient population *(Local Consensus [5])*.

    Note 3: There is no published validity and reliability for the CLIPer tool to date.

11. It is recommended that the patient be re-examined using the CLIPer on a monthly basis to determine the appropriate progression through the rehabilitation classification stages *(Local Consensus [5])*.

    Note 1: The patient is to be re-examined sooner if there is a change in status *(Local Consensus [5])*.

    Note 2: Pain, ROM, strength, gait, and balance will be monitored at each treatment visit to determine need for reassessment and reclassification using the CLIPer *(Local Consensus [5])*. (See Appendix 1 for instructions and score sheet).

12. It is recommended the patient is referred back to the orthopedic surgeon if the patient's status worsens over two consecutive PT sessions *(Local Consensus [5])*.

Management Recommendations

Physical Therapy Interventions

13. It is the recommendation that the patient diagnosed with LCP and is a candidate for conservative management receive supervised physical therapy intervention *(Local Consensus [5])*. (See Appendix 2 for algorithm).

    Note: Physical therapy interventions have been shown to improve ROM and strength in this patient population *(Brech 2006 [3b])*. Individuals who participate in supervised clinic visits demonstrate greater improvement in muscle strength, functional mobility, gait speed, and quality of exercise performance than those who receive a home exercise program alone or no instruction at all *(Friedrich 1996 [2b])*. Individuals who receive regular positive feedback from a physical therapist are more likely to be compliant with a supplemental home exercise program *(Sluijs 1993 [4b])*.

14. It is recommended that supervised physical therapy is supplemented with a customized written home exercise program *(Friedrich 1996 [2b])* in all phases of rehabilitation

15. It is recommended that the physical therapist engage in ongoing communication with the patient, family, and referring physician regarding the disease process and plan of care *(Local Consensus [5])*.

16. It is recommended that the patient begin physical therapy upon diagnosis of LCP *(Local Consensus [5])*.

17. It is recommended that advancement through the phases of rehabilitation follow a goal based rather than a time based progression.

    Note: Treatment is to focus on containment of the femoral head in the acetabulum throughout each phase of the disease *(Leach 2006 [5])*.

Phases of Rehabilitation

Severe Involvement Phase (CLIPer score 14 to 24)

18. It is recommended that goals of this phase include *(Local Consensus [5])*:
    - Reduce pain to less than 7/10

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- Increase ROM to 50% or greater of the uninvolved side
- Increase strength to 50% or greater of the uninvolved side
- Patient to be independent with the appropriate assistive device and weight bearing precautions
- Improve balance to 50% or greater of the maximum Pediatric Balance Scale score or single limb stance of the uninvolved side.

19. It is recommended that supervised Physical Therapy services are provided weekly *(Bailes 2008 [5a])* at a frequency of 2 times per week *(Local Consensus [5])*.

20. It is recommended that treatment interventions of the Severe Involvement Phase include:
    - **Pain**
      - Hot pack for pain management with stretching *(Nadler 2004 [1b])*
      - Cryotherapy *(Nadler 2004 [1b])*
      - Medications as prescribed by the referring physician for pain *(Local Consensus [5])*.
    - **ROM** (See Appendix 3 for exercise prescription)
      - Static stretch for LE musculature *(Moseley 2005 [2A], Bandy 1998 [2a], Davis 2005 [2b])* with or without use of a hot pack based on patient preference and comfort.
      - Dynamic ROM*(Bandy 1998 [2a])*and active assistive range of motion (AAROM) may be appropriate if the patient is muscle guarding due to pain and unable to achieve end range motion with static stretch *(Local Consensus [5])*.
      - Perform AROM and AAROM following passive stretching to maintain newly gained ROM *(Depino 2000 [2b])*.
      - Perform stretching in a position that is suitable for the individual and include hip IR, hip ER, hip abduction, hip extension, and any other lower extremity motion that is significantly limited *(Local Consensus [5])*.
    - **Strength** (See Appendix 4 for exercise prescription)
      - Begin with isometric exercise and progress to isotonic exercises in a gravity lessened position with further progression to isotonic exercises against gravity. It is appropriate to include concentric and eccentric contractions *(Brech 2006 [3b])*.
      - Begin with 2 sets of 10 to 15 repetitions of each exercise *(Rhea 2002 [2b], Faigenbaum 1996 [4b])*, with progression to 3 sets of each exercise to be used *(Rhea 2002 [2b])*.

        Note: If the patient is unable to perform 2 sets of 10 repetitions of an exercise, the difficulty of the exercise is to be decreased either through weight or type of exercise *(Local Consensus [5])*.
      - Focus on strengthening of hip abductors, hip flexors, hip external rotators, hip internal rotators, hip extensors, or any other lower extremity muscle group that displays significant strength deficits *(Westhoff 2006 [4b], Bolgla 2005 [4b])*. Special attention is to be given to the gluteus medius in order to minimize intraarticular pain *(Plasschaert 2006 [4b])* and for pelvic control during single leg activities and ambulation *(Westhoff 2006 [4b], Bolgla 2005 [4b])*.
      - Performance of weight bearing vs. non-weight bearing exercises is based on the weight bearing status as determined by the physician, patient's tolerance to weight bearing positions, and safety *(Local Consensus [5])*.
      - Weight bearing activities can be performed when the patient can apply weight on the involved extremity *(Bolgla 2005 [4b])* and safely perform the exercise in a standing position.
      - Closed chain double limb exercises with light resistance (less than full body weight) (e.g. Total Gym ®) may be performed *(Bolgla 2005 [4b])*.
      - It is not recommended to perform single limb closed chain exercises on the involved side *(Local Consensus [5])* due to increased intra-articular pressure in the hip joint *(Levangie 1992 [5])*.
    - **Balance**
      - Activities that include double limb stance and a narrowed base of support on stable surfaces may be performed if weight bearing status and symptoms allow *(Local Consensus [5])*.

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- It is not recommended to perform single limb activities *(Local Consensus [5])*due to increased intra-articular pressure in the hip joint *(Levangie 1992 [5])* .

- **Gait**
  - Follow the referring physician's guidelines for weight bearing status *(Local Consensus [5])*.
  - Begin gait training with the appropriate assistive device given weight bearing status as determined by the referring physician or based on the patient's tolerance to full weight bearing due to pain or safety *(Local Consensus [5])*.

Moderate Involvement Phase (CLIPer score 6 to 13)

21. It is recommended that goals of this phase include:
    - Reduce pain to less than 4/10
    - Increase ROM to greater than 75% of the uninvolved side
    - Increase strength to greater than 75% of the uninvolved side
    - Progress from use of an assistive device if approved by physician and without adverse effects
    - Independence with a step to pattern on stairs without UE support
    - Improved efficiency in walking
    - Improved balance to greater than 75% of the maximum Pediatric Balance Scale score or single limb stance of the uninvolved side

    (Local Consensus [5])
22. It is recommended that supervised Physical Therapy services are provided on a weekly basis *(Bailes 2008 [5a])* at a frequency of 1 to 2x/week *(Local Consensus [5])*.
23. It is recommended that treatment interventions of the Moderate Involvement Phase include:
    - **Pain**
      - Hot pack for pain management with stretching *(Nadler 2004 [1b])*
      - Cryotherapy *(Nadler 2004 [1b])*
      - Medications as prescribed by the referring physician for pain *(Local Consensus [5])*.
    - **ROM** (See Appendix 3 for exercise prescription)
      - Static stretch for LE musculature *(Moseley 2005 [2A], Bandy 1998 [2a], Davis 2005 [2b])* with or without use of a hot pack based on patient preference and comfort
      - Dynamic ROM *(Bandy 1998 [2a])*and AAROM may be appropriate if the patient is muscle guarding due to pain and unable to achieve end range motion with static stretch *(Local Consensus [5])*.
      - Perform AROM and AAROM following passive stretching to maintain newly gained ROM *(Depino 2000 [2b])*.
      - Perform stretching in a position that is suitable for the individual and include hip IR, hip ER, hip abduction, hip extension, and any other lower extremity motion that is significantly limited *(Local Consensus [5])*.
    - **Strengthening** (See Appendix 4 for exercise prescription.)
      - Perform isotonic exercises in gravity lessened and against gravity positions, and include concentric and eccentric contractions *(Brech 2006 [3b])*.
      - Weight bearing and non-weight bearing activities can be used in combination based on the patient's ability *(Jacobs 2008 [4b])* and goals of the treatment session.
      - Upper extremity supported functional dynamic single limb activities (e.g. step ups, side steps) may be performed *(Local Consensus [5])*.
      - Double limb closed chain exercises may be used with light resistance (e.g. mini-squats, wall-sits) if the weight bearing status allows *(Local Consensus [5])*.
    - **Balance**
      - Activities that include double limb stance with narrowed base of support on unstable surfaces may be performed as weight bearing status and patient comfort allow *(Local Consensus [5])*.
      - Limit prolonged single limb activities *(Local Consensus [5])* due to excessive joint compressive forces *(Levangie 1992 [5])*.
    - **Gait**
      - Continue to follow the referring physician's guidelines for weight bearing status *(Local Consensus [5])*.
      - Progress to gait training without use of an assistive device as appropriate, focusing on

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minimizing deficits and improving efficiency of walking *(Local Consensus [5])*.
  - Stair negotiation and other functional mobility *(Local Consensus [5])*.

Mild Involvement Phase (CLIPer score 0 to 5)

24. It is recommended that goals of this phase include:
    - Reduce pain to 1/10 or less
    - Increase range of motion to 90% or greater of the uninvolved side
    - Increase strength to 90% or greater of the uninvolved side
    - Improve balance to 90% or greater of the maximum Pediatric Balance Scale score or single limb stance of the uninvolved side
    - Ambulation with a non-painful limp with normal efficiency
      - Negotiation of stairs utilizing a reciprocal pattern

    (Local Consensus [5])

25. It is recommended that supervised physical therapy services are provided on a periodic or bimonthly basis *(Bailes 2008 [5a])* at a frequency of 1 to 2x/month *(Local Consensus [5])*.

26. It is recommended that treatment interventions of the Mild Involvement Phase include:
    - **Pain**
      - Hot pack for pain management with stretching *(Nadler 2004 [1b])*
      - Cryotherapy *(Nadler 2004 [1b])*
      - Medications as prescribed by the referring physician for pain *(Local Consensus [5])*
    - **ROM** (See Appendix 3 for exercise prescription.)
      - Static stretch for LE musculature *(Moseley 2005 [2A], Bandy 1998 [2a], Davis 2005 [2b])* with or without use of a hot pack based on patient preference and comfort *(Nadler 2004 [1b])*
      - Dynamic ROM *(Bandy 1998 [2a])*and AAROM may be used if the patient is muscle guarding due to pain and is unable to achieve end range of motion with static stretch *(Local Consensus [5])*.
      - Perform AROM and AAROM following passive stretching to maintain newly gained ROM *(Depino 2000 [2b])*.
      - Perform stretching in a position that is suitable for the individual and include hip IR, hip ER, hip abduction, hip extension, and any other lower extremity motion that is significantly limited *(Local Consensus [5])*.
    - **Strengthening** (See Appendix 4 for exercise prescription)
      - Isotonic exercises in gravity lessened and against gravity positions may be used and include concentric and eccentric contractions *(Brech 2006 [3b])*
      - Functional dynamic single limb activities with UE support as needed for patient safety (e.g. step ups, sidesteps) may be performed *(Local Consensus [5])*
      - Closed kinetic chain single limb exercises with light resistance (leg press) may be performed *(Bolgla 2005 [4b])*.
    - **Balance**
      - Double limb stance with narrowed base of support on unstable surfaces with perturbations may be performed as weight bearing status and patient comfort allow *(Local Consensus [5])*.
      - Limit prolonged single limb activities *(Local Consensus [5])* due to excessive joint compressive forces *(Levangie 1992 [5])*.
    - **Gait**
      - Continue to follow the referring physician's guidelines for weight bearing status
      - Progress to gait training without the use of an assistive device as appropriate, focusing on minimizing deficits and improving the efficiency of walking.
      - Stair negotiation and other functional mobility.
      - Progress to walking on uneven surfaces with an emphasis on safety.

    (Local Consensus [5])

Discharge Criteria

27. It is recommended that children may be discharged from physical therapy at the time of surgical intervention or when four of the five following criteria have been met:
    - Pain rating 0 to 1/10
    - Range of motion 90 to 100% of the uninvolved side
    - Strength 90 to 100% of the uninvolved side

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- Balance 90 to 100% of the maximum score on the Pediatric Balance Scale or maintaining balance with SLS 90 to 100% of the uninvolved side
- Gait presents with a non-painful limp and uses a reciprocal pattern on the stairs.

(Local Consensus [5])

28. It is recommended that following discharge from supervised physical therapy, the patient continue a home exercise program to maintain improvements in strength, balance, locomotor function, and pain management *(Local Consensus [5])* until it has been determined by the physician that the disease process is complete *(Local Consensus [5])*.
29. It is recommended that physical therapy services are provided as needed on a consultative basis *(Bailes 2008 [5a])* to manage flare up of symptoms or other concerns *(Local Consensus [5])*.
30. It is recommended that the post-operative guideline for LCP be followed when a patient is discharged from conservative management physical therapy due to surgical intervention. *(Local Consensus [5])*.

Future Research Agenda

1. In children ages 3 to 12 years old with Legg-Calve-Perthes disease, what is the reliability and validity of the Classification Instrument in Perthes (CLIPer)?
2. In children ages 3 to 12 years old with Legg-Calve-Perthes disease, what are the effects of weight bearing on symptoms, joint preservation, and function?

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Appendix 1

Classification Instrument in Perthes (CLIPer)			
Domains of Assessment	**Description**	**Score**	
Pain with ADLs	7 to10/10	4	
	4 to 6/10	2	
	0 to 3/10	0	
Hip ROM	Less than 50% of uninvolved side for the majority of directions	6	
	50 to 75% of uninvolved side for the majority of directions	3	
	76 to 100% of uninvolved side for the majority of directions	0	
Hip Strength	Less than 50% of uninvolved side for the majority of muscle groups	6	
	50 to 75% of uninvolved side for the majority of muscle groups	3	
	76 to 100% of uninvolved side for the majority of muscle groups	0	
Balance	Pediatric balance score less than 50% of best score (best score=56) OR SLS with eyes open less than 50% of time on uninvolved side	4	
	Pediatric balance score 50 to 75% of best score (best score=56) OR SLS with EO of uninvolved side 50 to 75% length of time	2	
	Pediatric balance score 76 to 100% of best score (best score=56) OR SLS with EO 76 to 100% of uninvolved side	0	
Gait	NWB and uses an assistive device and without AD, displays excessive gait deficits with decreased efficiency	4	
	No assistive device and displays excessive deficits without a decrease in efficiency Uses step to pattern on stairs	2	
	Non-painful limp Able to perform reciprocal pattern on stairs	0	
		TOTAL:	
Rehabilitation Classification Phase **Score total 14 to 24: Severe Involvement** **Score total 6 to 13: Moderate Involvement** **Score total 0 to 5: Mild Involvement**			

Instructions for use

Upon examination, assess pain with ADL's, hip range of motion, hip strength, balance, and gait. Assign a correlating score for each domain of assessment based on examination results and total the sum. Place the patient in a rehabilitation classification phase based on the total score to guide physical therapy treatment.

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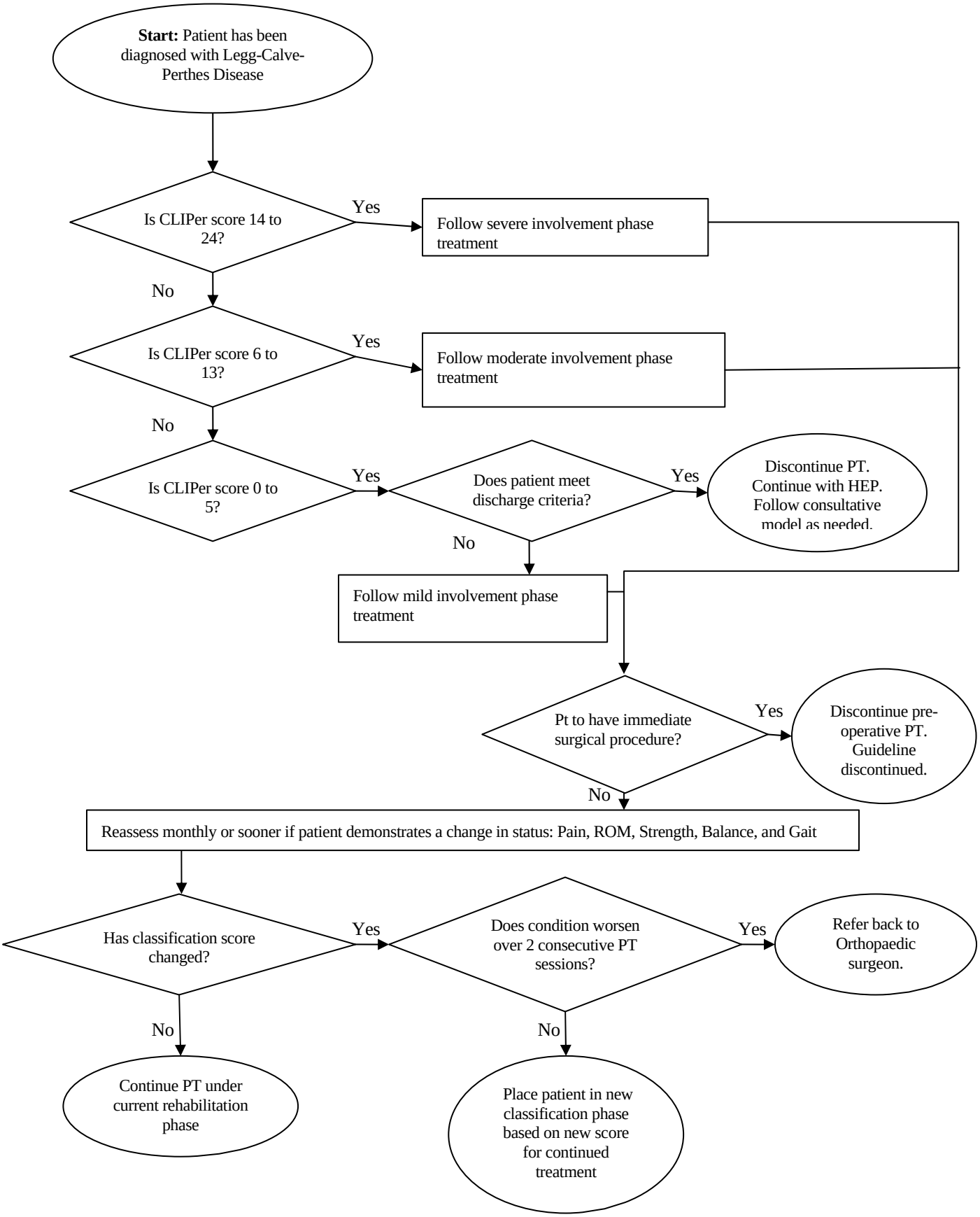
Appendix 2



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Appendix 3

ROM Exercise Prescription				
Intervention	**Parameters**	**Intensity**	**Notes**	**Muscle Groups**
Static Stretch	• **2 minutes of stretching per day, per muscle group** *(Santonja Medina 2007 [2b], Cipriani 2003 [4b])*. • **30 second hold time**, doing 4 repetitions per muscle group *(Bandy 1994 [2a], Reid 2004 [2b], Depino 2000 [2b])*. • If not tolerated, may do 10 to 30 second hold time with repetitions adjusted to meet 2 minute requirement (e.g. if holding 15 seconds, would do 8 stretches) *(Cipriani 2003 [4b], Roberts 1999 [4b])*.	• Gentle static hold • Should be within patient pain tolerance and without muscle guarding so as to prevent tissue damage and inflammatory response *(Bandy 1994 [2a], Santonja Medina 2007 [2b], Davis 2005 [2b])*.	• This is the preferred method of stretching to gain flexibility and/or ROM *(Moseley 2005 [2A], Bandy 1994 [2a], Davis 2005 [2b])*. • stretching be done after warm up, but prior to active exercises to maintain newly gained ROM *(Depino 2000 [2b])*.	Any limited motions or tight muscles in the lower extremities should be addressed, but with particular emphasis on the following: • hip adductors • hip internal rotators • hip external rotators • hip flexors *(Local Consensus [5])*
Dynamic Stretch	• **5 second hold, done with 24 repetitions per muscle group per day** to meet 2 minute stretching time required *(Bandy 1998 [2a], Santonja Medina 2007 [2b], Cipriani 2003 [4b])*.	• Self-selected intensity by patient as long as not causing pain	• Dynamic stretch is done with patient activation of antagonistic muscle group *(Bandy 1998 [2a])*. • This is done if patient does not tolerate static stretch	

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Appendix 4

Strengthening Exercise Prescription				
Intervention	**Parameters**	**Intensity**	**Notes**	**Muscle Groups**
Isometric Strengthening	• **10 second hold with 10 repetitions** per muscle group, for a total of 100 seconds *(Local Consensus [5])*. • Can adjust hold time to 5 seconds, would then adjust to 20 repetitions to meet 100 second requirement	• Performed at approximately 75% maximal contraction *(Local Consensus [5])*	• Performed with hip in neutral position, o 0 degrees hip flexion/extension, o 0 degrees hip abduction/adduction and o 0 degrees hip external/internal rotation *(Local Consensus [5])*	Any lower extremity muscle that demonstrates weakness should be addressed, however, special attention should be given to the following: • hip abductors (especially gluteus medius) • hip internal rotators • hip external rotators • hip flexors • hip extensors *(Plasschaert 2006 [4b], Westhoff 2006 [4b], Bolgla 2005 [4b])*
Isotonic Strengthening	• **High repetitions (10 to 15 reps) and 2 to 3 sets** *(Campos 2002 [2b], Faigenbaum 1999 [2b])*. • Perform both concentric and eccentric contractions *(Brech 2006 [3b])*	• **Low resistance** • Rest 1 to 3 minutes between sets *(Campos 2002 [2b], Jacobs 2008 [4b], Bolgla 2005 [4b])*(depending on strength and endurance) • Rest can include exercise of a different muscle group or cessation of activity	• If patient is unable to perform 2 sets of 10 repetitions with proper form, exercise intensity should be decreased either through weight or type of exercise	

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Development Process

The process by which this guideline was developed is documented in the Guideline Development Process Manual ; a Team Binder maintains minutes and other relevant development materials. The recommendations contained in this guideline were formulated by an interdisciplinary working group which performed systematic search and critical appraisal of the literature, using the Table of Evidence Levels described following the references, and examined current local clinical practices.

To select evidence for critical appraisal by the group for this guideline, the Medline, EmBase and the Cochrane databases were searched for dates of January 1970 to April 2009 to generate an unrefined, "combined evidence" database using a search strategy focused on answering clinical questions relevant to Legg-Calve-Perthes Disease and employing a combination of Boolean searching on human-indexed thesaurus terms (MeSH headings using an OVID Medline interface) and "natural language" searching on searching on human-indexed thesaurus terms (MeSH headings using an OVID Medline interface) and "natural language" searching on words in the title, abstract, and indexing terms. The citations were reduced by: eliminating duplicates, review articles, non-English articles, and adult articles. The resulting abstracts were reviewed by a methodologist to eliminate low quality and irrelevant citations. During the course of the guideline development, additional clinical questions were generated and subjected to the search process, and some relevant review articles were identified.

Tools to assist in the effective dissemination and implementation of the guideline may be available online at http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/ev-based/default.htm . Experience with the implementation of earlier publications of this guideline has provided learnings which have been incorporated into this revision.

Once the guideline has been in place for three years, the development team reconvenes to explore the continued validity of the guideline. This phase can be initiated at any point that evidence indicates a critical change is needed.

The guideline was externally appraised by two reviewers[b] using the AGREE instrument and the results by domain are:

- Scope and Purpose 89%
- Stakeholder Involvement 67%
- Rigor of Development 65%
- Clarity and Presentation 78%
- Applicability 46%
- Editorial Independence 100%

Recommendations have been formulated by a consensus process directed by best evidence, patient and family preference and clinical expertise. During formulation of these recommendations, the team members have remained cognizant of controversies and disagreements over the management of these patients. They have tried to resolve controversial issues by consensus where possible and, when not possible, to offer optional approaches to care in the form of information that includes best supporting evidence of efficacy for alternative choices.

The guideline has been reviewed and approved by clinical experts not involved in the development process, distributed to senior management, and other parties as appropriate to their intended purposes.

The guideline was developed without external funding. All Team Members and Anderson Center support staff listed have declared whether they have any conflict of interest and none were identified.

Copies of this Evidence-based Care Guideline (EBCG) and its any available implementation tools are available online and may be distributed by any organization for the global purpose of improving child health outcomes. Website address: http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/ev-based/default.htm Examples of approved uses of the EBCG include the following:

- copies may be provided to anyone involved in the organization's process for developing and implementing evidence based care guidelines;
- hyperlinks to the CCHMC website may be placed on the organization's website;
- the EBCG may be adopted or adapted for use within the organization, provided that CCHMC receives appropriate attribution on all written or electronic documents; and
- copies may be provided to patients and the clinicians who manage their care.

Notification of CCHMC at EBDMinfo@cchmc.org for any EBCG, or its companion documents, adopted, adapted, implemented or hyperlinked by the organization is appreciated.

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NOTE: These recommendations result from review of literature and practices current at the time of their formulations. This guideline does not preclude using care modalities proven efficacious in studies published subsequent to the current revision of this document. This document is not intended to impose standards of care preventing selective variances from the recommendations to meet the specific and unique requirements of individual patients. Adherence to this guideline is voluntary. The clinician in light of the individual circumstances presented by the patient must make the ultimate judgment regarding the priority of any specific procedure.

For more information about this guideline, its supporting evidence and the guideline development process, contact the Division of Occupational Therapy and Physical Therapy at: 513-636-4651 or OTPT@cchmc.org.

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References

Note: When using the electronic version of this document, ☜ indicates a hyperlink to the PubMed abstract. A hyperlink following this symbol goes to the article PDF when the user is within the CCHMC network.

1. **APTA:** Who Are Physical Therapists, and What Do They Do? In *Guide To Physical Therapy Practice*. Edited by Association, A. P. T., Alexandria, VA, APTA, 2001, *[5]* ☜.
2. **Bailes, A. F.; Reder, R.; and Burch, C.:** Development of guidelines for determining frequency of therapy services in a pediatric medical setting. *Pediatr Phys Ther*, 20(2): 194-8, 2008, *[5a]* ☜.
3. **Bandy, W. D.; Irion, J. M.; Bandy, W. D.; and Irion, J. M.:** The effect of time on static stretch on the flexibility of the hamstring muscles.[see comment]. *Physical Therapy*, 74(9): 845-50; discussion 850-2, 1994, *[2a]* ☜.
4. **Bandy, W. D.; Irion, J. M.; and Briggler, M.:** The effect of static stretch and dynamic range of motion training on the flexibility of the hamstring muscles. *J Orthop Sports Phys Ther*, 27(4): 295-300, 1998, *[2a]* ☜.
5. **Beyer, J. E.; Turner, S. B.; Jones, L.; Young, L.; Onikul, R.; and Bohaty, B.:** The alternate forms reliability of the Oucher pain scale. *Pain Manag Nurs*, 6(1): 10-7, 2005, *[4a]* ☜.
6. **Bolgla, L. A., and Uhl, T. L.:** Electromyographic analysis of hip rehabilitation exercises in a group of healthy subjects. *J Orthop Sports Phys Ther*, 35(8): 487-94, 2005, *[4b]* _____ ☜.
7. **Brech, G. C.; Guarnieiro, R.; Brech, G. C.; and Guarnieiro, R.:** Evaluation of physiotherapy in the treatment of Legg-Calve-Perthes disease. *Clinics (Sao Paulo, Brazil)*, 61(6): 521-8, 2006, *[3b]* ☜.
8. **Campos, G. E. et al.:** Muscular adaptations in response to three different resistance-training regimens: specificity of repetition maximum training zones. *Eur J Appl Physiol*, 88(1-2): 50-60, 2002, *[2b]* _____ ☜.
9. **Canavese, F., and Dimeglio, A.:** Perthes' disease: prognosis in children under six years of age. *Journal of Bone & Joint Surgery - British Volume*, 90(7): 940-5, 2008, *[4b]* ☜.
10. **Cipriani, D.; Abel, B.; and Pirrwitz, D.:** A comparison of two stretching protocols on hip range of motion: implications for total daily stretch duration. *Journal Of Strength And Conditioning Research / National Strength & Conditioning Association*, 17(2): 274-278, 2003, *[4b]* ☜.
11. **Clapper, M. P., and Wolf, S. L.:** Comparison of the reliability of the Orthoranger and the standard goniometer for assessing active lower extremity range of motion. *Phys Ther*, 68(2): 214-8, 1988, *[4b]* ☜.
12. **Davis, D. S.; Ashby, P. E.; McCale, K. L.; McQuain, J. A.; and Wine, J. M.:** The effectiveness of 3 stretching techniques on hamstring flexibility using consistent stretching parameters. *J Strength Cond Res*, 19(1): 27-32, 2005, *[2b]* _____ ☜.
13. **Depino, G. M.; Webright, W. G.; and Arnold, B. L.:** Duration of Maintained Hamstring Flexibility After Cessation of an Acute Static Stretching Protocol. *J Athl Train*, 35(1): 56-59, 2000, *[2b]* ☜.
14. **Escolar, D. M.; Henricson, E. K.; Mayhew, J.; Florence, J.; Leshner, R.; Patel, K. M.; and Clemens, P. R.:** Clinical evaluator reliability for quantitative and manual muscle testing measures of strength in children. *Muscle Nerve*, 24(6): 787-93, 2001, *[4b]* _____ ☜.
15. **Faigenbaum, A. D.; Westcott, W. L.; Loud, R. L.; and Long, C.:** The effects of different resistance training protocols on muscular strength and endurance development in children. *Pediatrics*, 104(1): e5, 1999, *[2b]* _____ ☜.
16. **Faigenbaum, A. D.; Westcott, W. L.; Micheli, L. J.; Outerbridge, A. R.; Long, C. J.; LaRosa-Loud, R.; and Zaichkowsky, L. D.:** The Effects of Strength Training and Detraining on Children. *Journal of Strength & Conditioning Research*, 10(2): 109-114, 1996, *[4b]* ☜.
17. **Franjoine, M. R.; Gunther, J. S.; and Taylor, M. J.:** Pediatric balance scale: a modified version of the berg balance scale for the school-age child with mild to moderate motor impairment. *Pediatr Phys Ther*, 15(2): 114-28, 2003, *[4b]* ☜.
18. **Friedrich, M.; Cermak, T.; and Maderbacher, P.:** The effect of brochure use versus therapist teaching on patients performing therapeutic exercise and on changes in impairment status. *Phys Ther*, 76(10): 1082-8, 1996, *[2b]* ☜.
19. **Gajdosik, C. G.:** Ability of very young children to produce reliable isometric force measurements. *Pediatr Phys Ther*, 17(4): 251-7, 2005, *[4b]* ☜.
20. **Grzegorzewski, A. et al.:** The role of the acetabulum in Perthes disease. *Journal of Pediatric Orthopedics*, 26(3): 316-21, 2006, *[4b]* ☜.
21. **Herring, J. A.:** Legg-Calves-Perthes Disease. In *Tachdjian's Pediatric Orthopaedics*, pp. 675. Edited by Herring, J. A., Elsevier Health Sciences, 2001, *[5]* ☜.
22. **Herring, J. A.; Kim, H. T.; and Browne, R.:** Legg-Calve-Perthes disease. Part I: Classification of radiographs with use of the modified lateral pillar and Stulberg classifications. *Journal of Bone & Joint Surgery - American Volume*, 86-A(10): 2103-20, 2004, *[4b]* ☜.
23. **Herring, J. A.; Kim, H. T.; Browne, R.; Herring, J. A.; Kim, H. T.; and Browne, R.:** Legg-Calve-Perthes disease. Part II: Prospective multicenter study of the effect of treatment on outcome.[see comment]. *Journal of Bone & Joint Surgery - American Volume*, 86-A(10): 2121-34, 2004, *[3b]* ☜.
24. **Jacobs, C. A.; Lewis, M.; Bolgla, L. A.; Christensen, C. P.; Nitz, A. J.; and Uhl, T. L.:** Electromyographic Analysis of Hip Abductor Exercises Performed by a Sample of Total Hip Arthroplasty Patients. *J Arthroplasty*, 2008, *[4b]* ☜.
25. **Leach, J.:** Orthopedic Conditions. In *Physical Therapy for Children*, pp. 498-499. Edited by Campbell, S.; Palisano, R.; and Vander Linden, D., Saunders, 2006, *[5]* ☜.
26. **Levangie, P., and Norkin, C.:** The Hip Complex. In *Joint structure and function: a comprehensive analysis* pp. 326. Edited by Levangie, P., and Norkin, C., Philadelpha FA Davis Philadelpha, 1992, *[5]* ☜.
27. **Local Consensus:** during the guideline development timeframe. ed., *[5]*☜.

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28. **Moseley, A. M.; Herbert, R. D.; Nightingale, E. J.; Taylor, D. A.; Evans, T. M.; Robertson, G. J.; Gupta, S. K.; and Penn, J.:** Passive stretching does not enhance outcomes in patients with plantarflexion contracture after cast immobilization for ankle fracture: a randomized controlled trial. *Arch Phys Med Rehabil,* 86(6): 1118-26, 2005, *[2A]* _____ ☜.

29. **Nadler, S. F.; Weingand, K.; and Kruse, R. J.:** The physiologic basis and clinical applications of cryotherapy and thermotherapy for the pain practitioner. *Pain Physician,* 7(3): 395-9, 2004, *[1b]* ☜.

30. **Plasschaert, V. F. et al.:** Hip abductor function in adults treated for Perthes disease. *Journal of Pediatric Orthopaedics, Part B,* 15(3): 183-9, 2006, *[4b]* ☜.

31. **Rao, K. N., and Joseph, B.:** Value of measurement of hip movements in childhood hip disorders. *Journal of Pediatric Orthopedics,* 21(4): 495-501, 2001, *[4b]* ☜.

32. **Reid, D. A., and McNair, P. J.:** Passive force, angle, and stiffness changes after stretching of hamstring muscles. *Med Sci Sports Exerc,* 36(11): 1944-8, 2004, *[2b]* ☜.

33. **Rhea, M. R.; Alvar, B. A.; Ball, S. D.; and Burkett, L. N.:** Three sets of weight training superior to 1 set with equal intensity for eliciting strength. *Journal of Strength & Conditioning Research,* 16(4): 525-9, 2002, *[2b]* ☜.

34. **Roberts, J. M., and Wilson, K.:** Effect of stretching duration on active and passive range of motion in the lower extremity. *Br J Sports Med,* 33(4): 259-63, 1999, *[4b]* _____☜.

35. **Santonja Medina, F. M.; Sainz De Baranda Andujar, P.; Rodriguez Garcia, P. L.; Lopez Minarro, P. A.; and Canteras Jordana, M.:** Effects of frequency of static stretching on straight-leg raise in elementary school children. *Journal of Sports Medicine & Physical Fitness,* 47(3): 304-8, 2007, *[2b]* ☜.

36. **Sluijs, E. M.; Kok, G. J.; and van der Zee, J.:** Correlates of exercise compliance in physical therapy. *Phys Ther,* 73(11): 771-82; discussion 783-6, 1993, *[4b]* ☜.

37. **Tamai, J.; Bulent, E.; and Dormans, J.:** Hip Disorders. In *Pediatric Orthopaedics and Sports Medicine: The Requisites in Pediatrics Series. Requisite Series, Mosby (An affiliate of Elsevier),* pp. 191-195. Edited by Bell, L., St. Louis, Mosby, 2004, *[5]* ☜.

38. **Toro, B.; Nester, C. J.; and Farren, P. C.:** A review of observational gait assessment in clinical practice. *Physiotherapy Theory and Practice,* 19: 137-149, 2003, *[1b]* ☜.

39. **Varni, J. W.; Limbers, C. A.; and Burwinkle, T. M.:** How young can children reliably and validly self-report their health-related quality of life?: an analysis of 8,591 children across age subgroups with the PedsQL 4.0 Generic Core Scales. *Health Qual Life Outcomes,* 5: 1, 2007a, *[4a]* ☜.

40. **Varni, J. W.; Limbers, C. A.; and Burwinkle, T. M.:** Parent proxy-report of their children's health-related quality of life: an analysis of 13,878 parents' reliability and validity across age subgroups using the PedsQL 4.0 Generic Core Scales. *Health Qual Life Outcomes,* 5: 2, 2007b, *[4a]* ☜.

41. **Varni, J. W.; Seid, M.; and Kurtin, P. S.:** PedsQL 4.0: reliability and validity of the Pediatric Quality of Life Inventory version 4.0 generic core scales in healthy and patient populations. *Med Care,* 39(8): 800-12, 2001, *[4a]* ☜.

42. **von Baeyer, C. L.; Spagrud, L. J.; McCormick, J. C.; Choo, E.; Neville, K.; and Connelly, M. A.:** Three new datasets supporting use of the Numerical Rating Scale (NRS-11) for children's self-reports of pain intensity. *Pain,* 143(3): 223-7, 2009, *[4b]* ☜.

43. **Weinstein, S. L.:** Natural history and treatment outcomes of childhood hip disorders. *Clin Orthop Relat Res,* (344): 227-42, 1997, *[5a]* ☜.

44. **Wenger, D. R.; Ward, W. T.; and Herring, J. A.:** Legg-Calve-Perthes disease. *Journal of Bone & Joint Surgery - American Volume,* 73(5): 778-88, 1991, *[5a]* ☜.

45. **Westhoff, B.; Petermann, A.; Hirsch, M. A.; Willers, R.; and Krauspe, R.:** Computerized gait analysis in Legg Calve Perthes disease--analysis of the frontal plane. *Gait Posture,* 24(2): 196-202, 2006, *[4b]* _____☜.

46. **Williamson, A., and Hoggart, B.:** Pain: a review of three commonly used pain rating scales. *J Clin Nurs,* 14(7): 798-804, 2005, *[1b]* ☜.

47. **Yoo, W. J.; Choi, I. H.; Cho, T. J.; Chung, C. Y.; Park, M. S.; and Lee, D. Y.:** Out-toeing and in-toeing in patients with Perthes disease: role of the femoral hump. *J Pediatr Orthop,* 28(7): 717-22, 2008, *[4b]* _____ ☜.

Note: Full tables of evidence grading system available in separate documents:

- Table of Evidence Levels of Individual Studies by Domain, Study Design, & Quality (abbreviated table below)
- Grading a Body of Evidence to Answer a Clinical Question
- Judging the Strength of a Recommendation (abbreviated table below)

Table of Evidence Levels (see note above)

Quality level	*Definition*
1a† or 1b†	Systematic review, meta-analysis, or meta-synthesis of multiple studies
2a or 2b	Best study design for domain
3a or 3b	Fair study design for domain
4a or 4b	Weak study design for domain
5	Other: General review, expert opinion, case report, consensus report, or guideline

†a = good quality study; b = lesser quality study

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Table of Recommendation Strength (see note above)

Strength	***Definition***
"Strongly recommended"	There is consensus that benefits clearly outweigh risks and burdens (or visa-versa for negative recommendations).
"Recommended"	There is consensus that benefits are closely balanced with risks and burdens.
No recommendation made	There is lack of consensus to direct development of a recommendation.

Dimensions: In determining the strength of a recommendation, the development group makes a considered judgment in a consensus process that incorporates critically appraised evidence, clinical experience, and other dimensions as listed below.

1. Grade of the Body of Evidence (see note above)
2. Safety / Harm
3. Health benefit to patient *(direct benefit)*
4. Burden to patient of adherence to recommendation *(cost, hassle, discomfort, pain, motivation, ability to adhere, time)*
5. Cost-effectiveness to healthcare system *(balance of cost / savings of resources, staff time, and supplies based on published studies or onsite analysis)*
6. Directness *(the extent to which the body of evidence directly answers the clinical question [population/problem, intervention, comparison, outcome])*
7. Impact on morbidity/mortality or quality of life

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