



Rehabilitation Factors in Pre-Arthritic Hip Disease

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SCHOOL OF MEDICINE



K23HD67343



K12 HD055931



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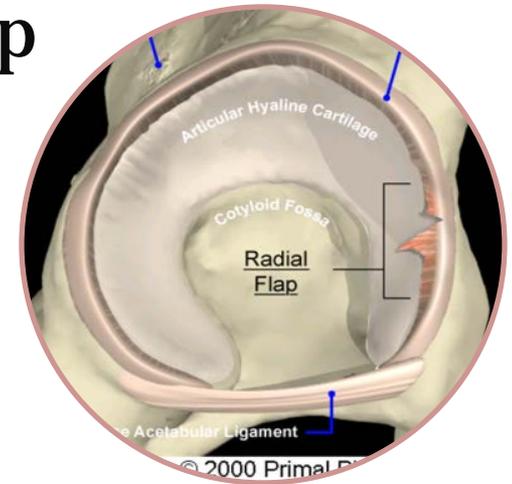
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I have no financial relationships to disclose.

Pre-arthritic hip disease

- aka Intra-articular, Nonarthritic hip disease/disorder
- Associated Diagnoses
 - Femoroacetabular impingement
 - Structural instability (Hip dysplasia)
 - Labral tears, chondral lesions, ligamentum teres tear



Proposed risk factors

- Bony abnormalities
- Activity type/intensity
- Movement related factors
 - Muscle performance
 - Movement patterns

Early disease

Pre-arthritic hip disease

- Joint pain and loss of function with no radiographic evidence of arthritis

Late disease

Hip Osteoarthritis



Okana J. Ortho Science 2008

Narvani AA. Knee Surg 2003

McCarthy JC. Clin Orthop Relat Res 2001

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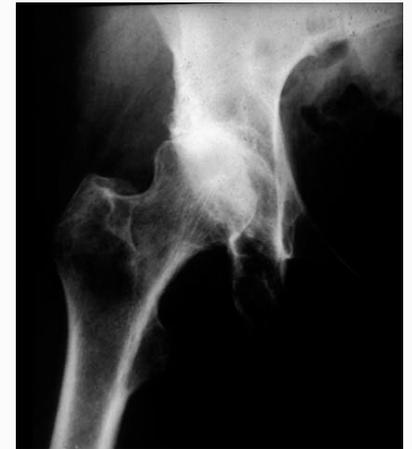
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Ganz R. Clin Orthop Relat Res 2008
Harris-Hayes M et al. (Review) PMR 2011



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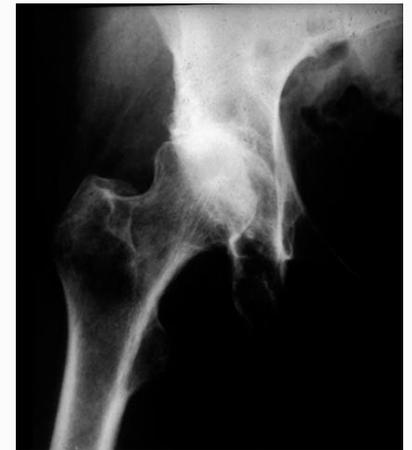
Early disease

Pre-arthritic hip disease

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Rehabilitation Strategies Needed

- Identify risk factors
- Rehabilitation to address modifiable factors.
- Teach compensation for non modifiable factors.

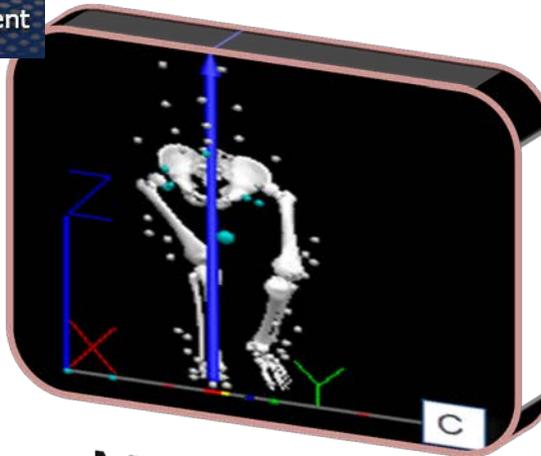
Limited Evidence



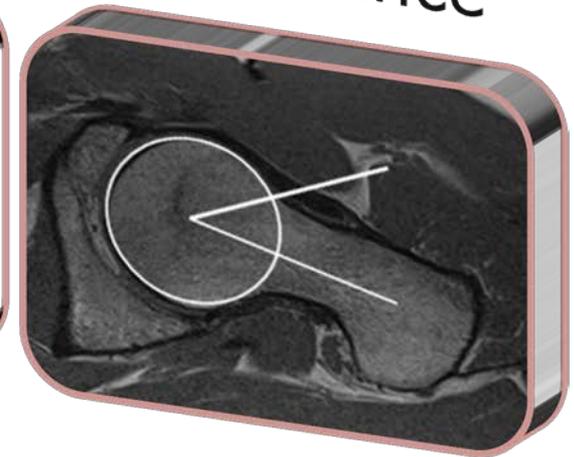
Activity



Muscle performance



Movement Patterns



Bony Structure

Rehabilitation Factors in Pre-Arthritic Hip Disease

National Institutes of Health
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National Institute of Child Health & Human Development
K23HD67343

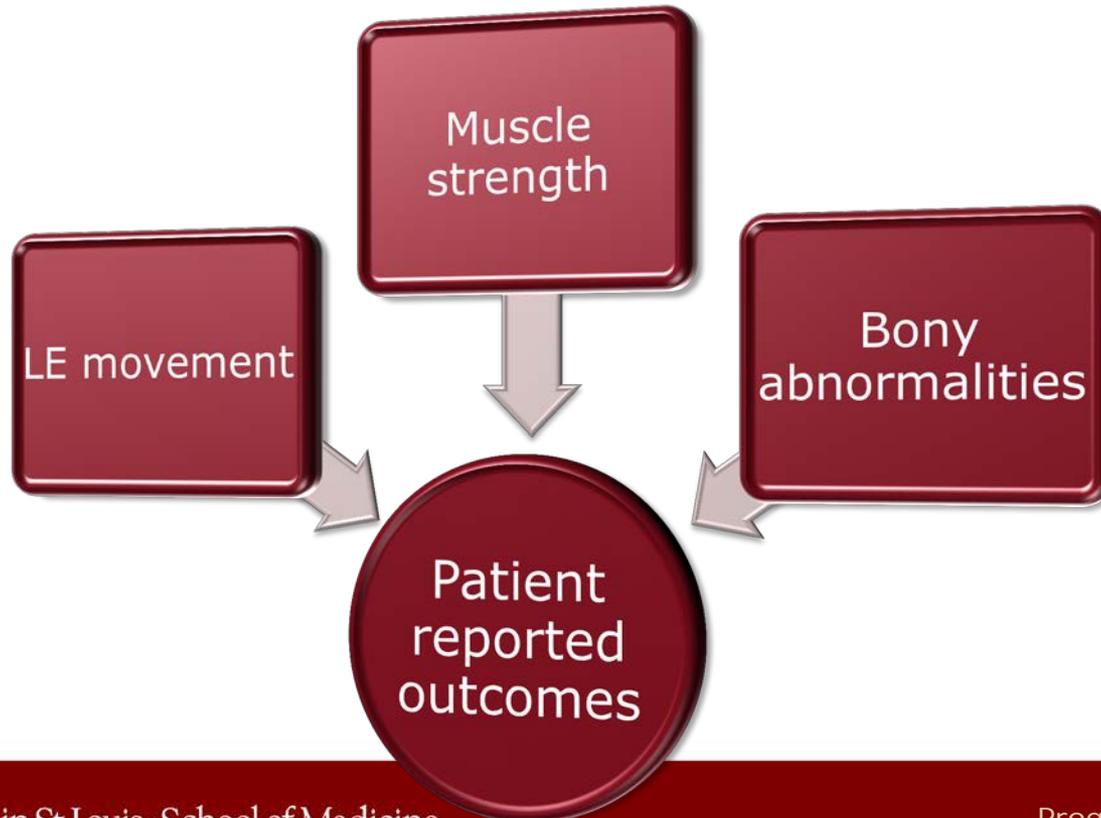


Aims

- **Aim 1:** Determine the differences between people without hip pain and people with chronic PAHD
 - Lower extremity (LE) movement patterns
 - Hip abductor and external rotator strength
 - Bony abnormalities

Aims

- **Aim 2:** Determine the association among LE movement patterns, muscle strength, bony abnormalities and hip-specific outcome scores.





Research Proposal

Prospective Cohort design

- Compare (N=80)
 - People with PAHD
 - People without hip pain (Matched Controls)
 - Measures
 - Patient-reported outcomes (self-report questionnaires)
 - Focused Clinical exam (strength assessment)
 - Kinematic assessment (movement patterns)
 - Magnetic Resonance Imaging (bony abnormalities)
- Pilot treatment trial
 - 6 weeks rehabilitation – Movement Pattern Training
 - Modifying abnormal movement pattern
 - Hip muscle strengthening



Aims

- **Aim 3:** To obtain preliminary data on the effectiveness of movement pattern training
 - exploratory randomized time-control treatment trial
 - immediate-treatment group
 - delayed-treatment group
 - both groups will receive movement pattern training.

Movement patterns - Classification

- **Systematic exam – Visual appraisal**
 - Identify movement pattern associated with pain behavior
 - Likely performed repetitively during functional activities
 - May be contributor to pain or persistence of pain after injury

Sahrmann SA, 2002



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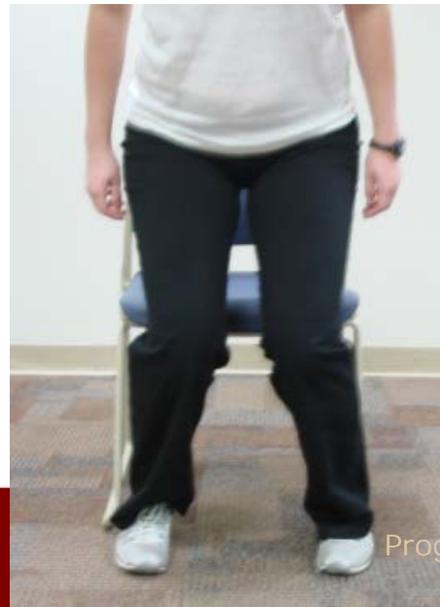


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Sahrmann SA, 2002

- Treatment approach
 - Modify movement pattern
 - Reduce stresses to tissues
 - Reduce pain, improve function



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Sahrmann SA, 2002

- Treatment approach
 - Modify movement pattern
 - Reduce stresses to tissues
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Movement patterns - Classification

- Dynamic Knee Valgus (DKV)/Medial collapse (MC)
 - Lower Extremity disorders
 - Acetabular labral tear

Austin 2008

- ACL injury

Hewett TE et al

- Patellofemoral pain

Salsich 2012

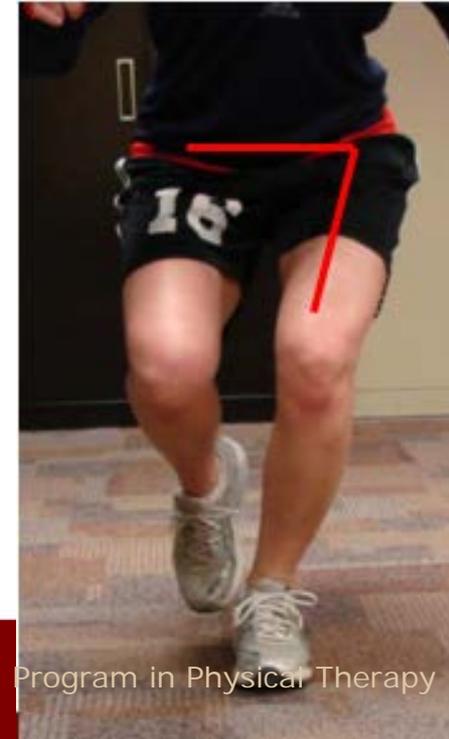
Powers CM 2003

Lee 2001

DKV/MC



No DKV/MC





Research Proposal

Prospective Cohort design

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- **Pilot treatment trial**
 - 6 weeks rehabilitation – Movement Pattern Training
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Subjects

- **Inclusion**
 - 18-40 yrs
 - **Chronic PAHD**
 - Deep hip joint or groin pain present greater than 3 months
 - Reproduced with anterior impingement test
 - **Asymptomatic**
 - Without history hip pain
 - Matched: Age, Gender, BMI and limb side
- **Exclusion criteria**
 - BMI > 30
 - Previous surgery or fracture of hip
 - Contraindications for MRI, pregnancy, implanted devices



Exploratory randomized time-control treatment trial

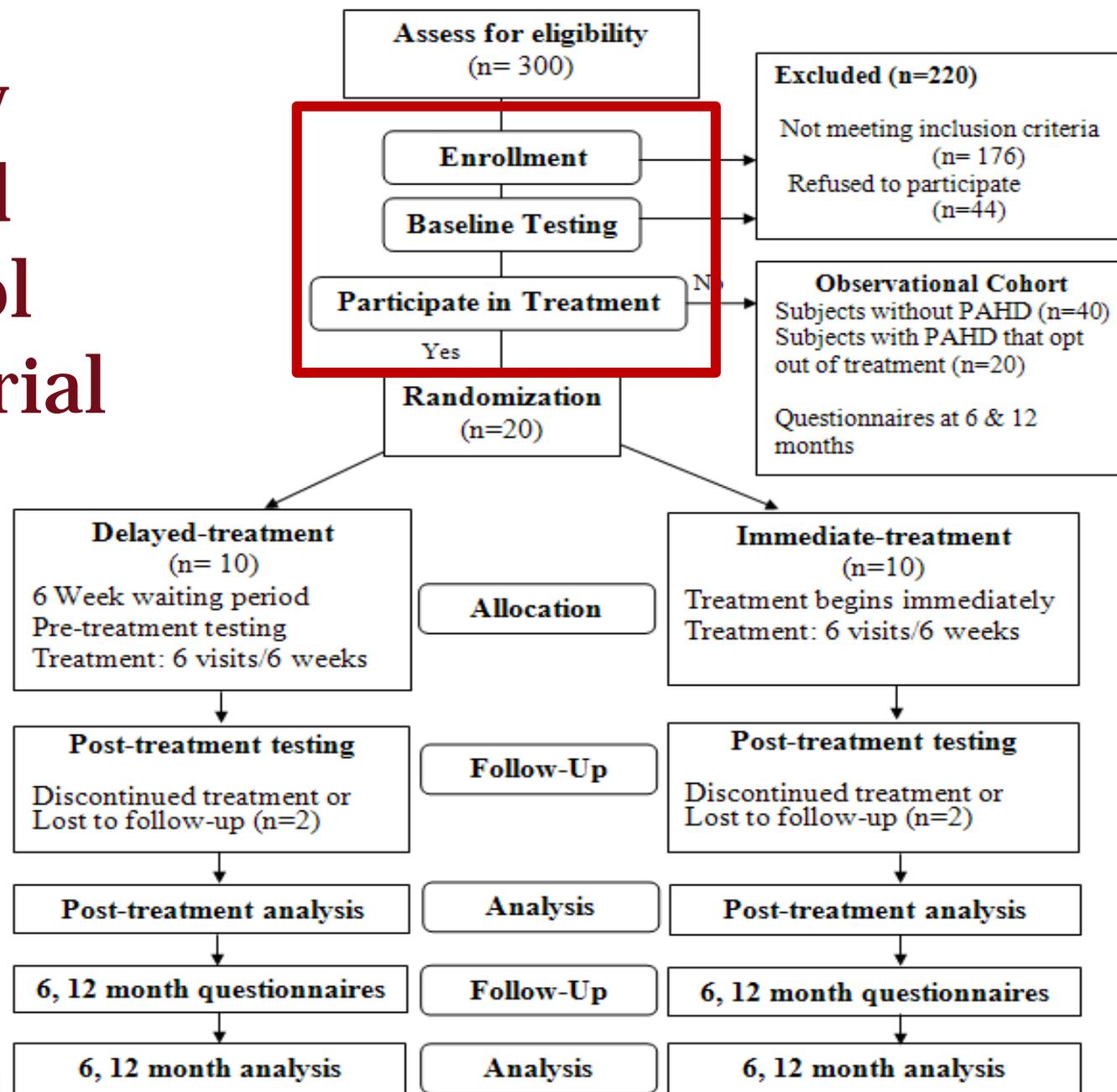


Figure 4. Study flow diagram. CONSORT flow diagram adapted. Sample estimates based on previous study.

Exploratory randomized time-control treatment trial

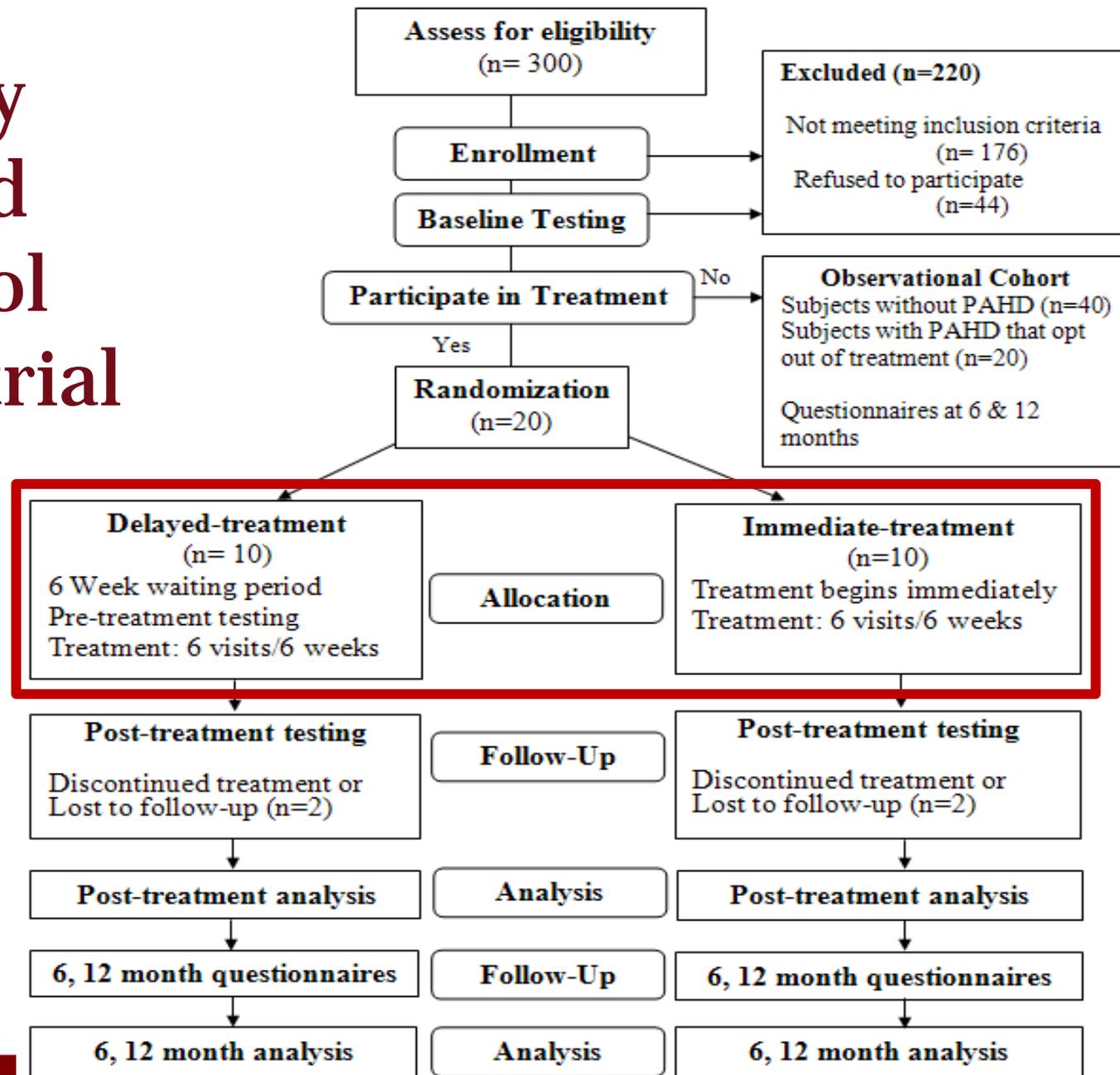


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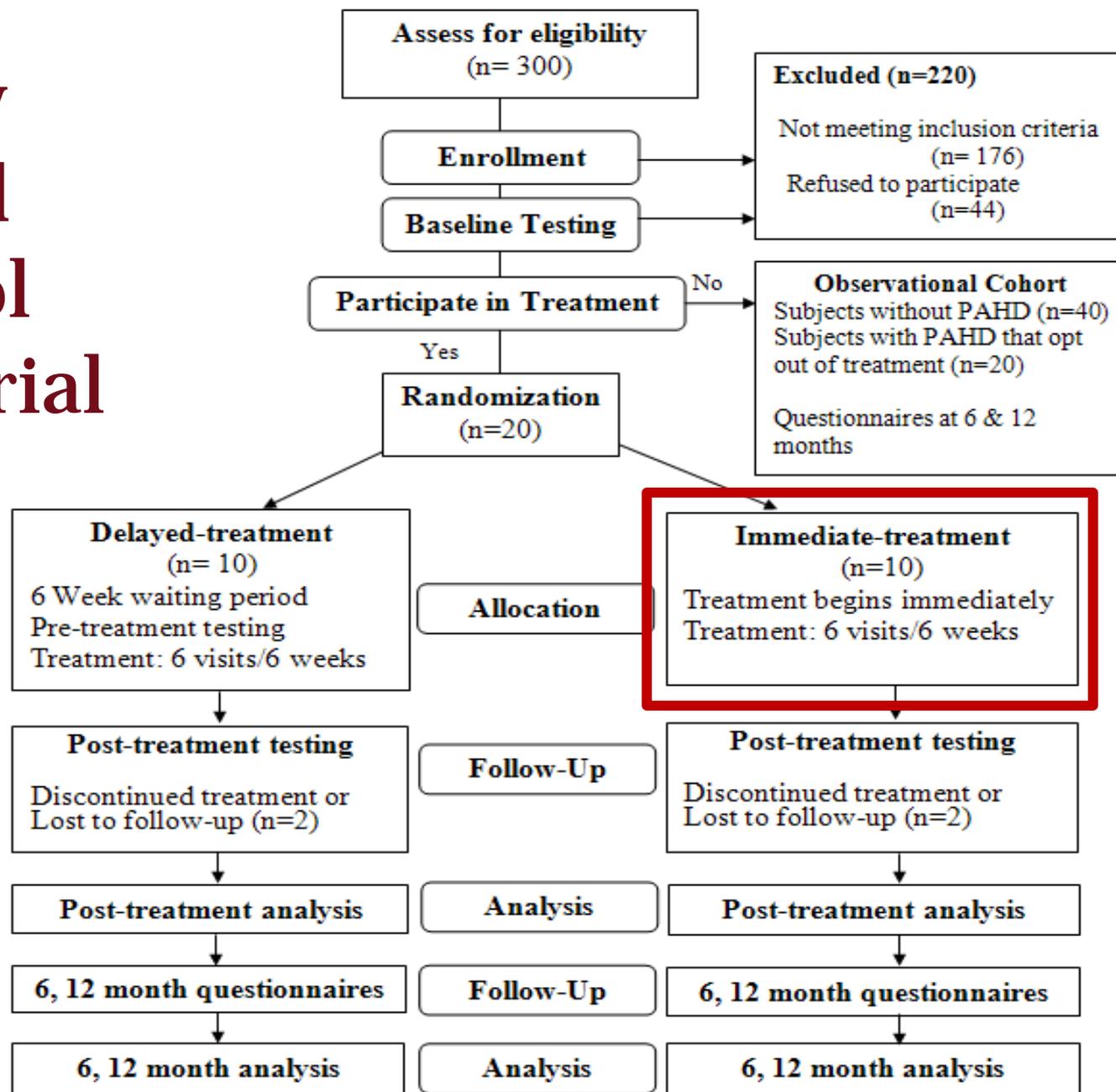


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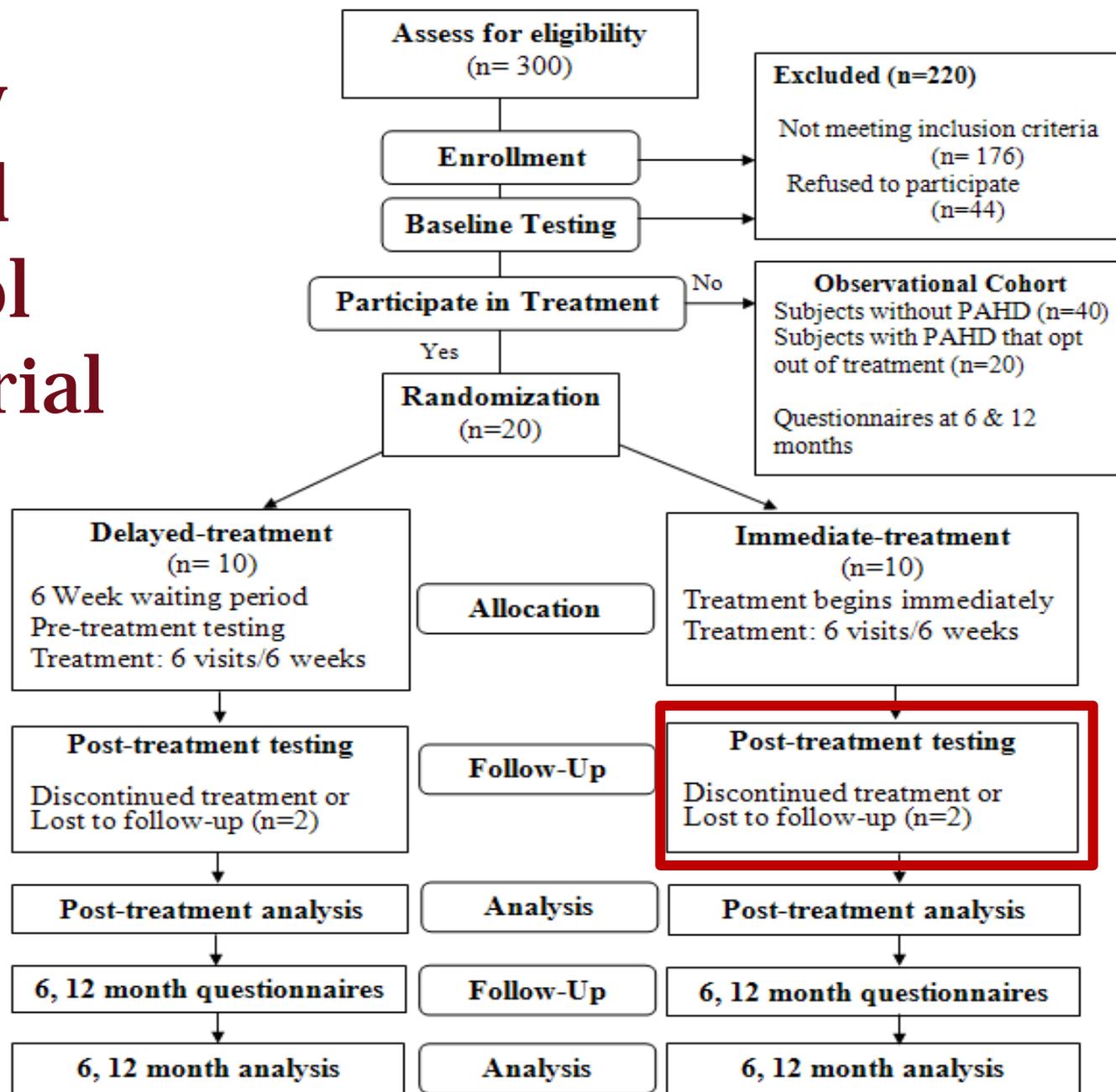


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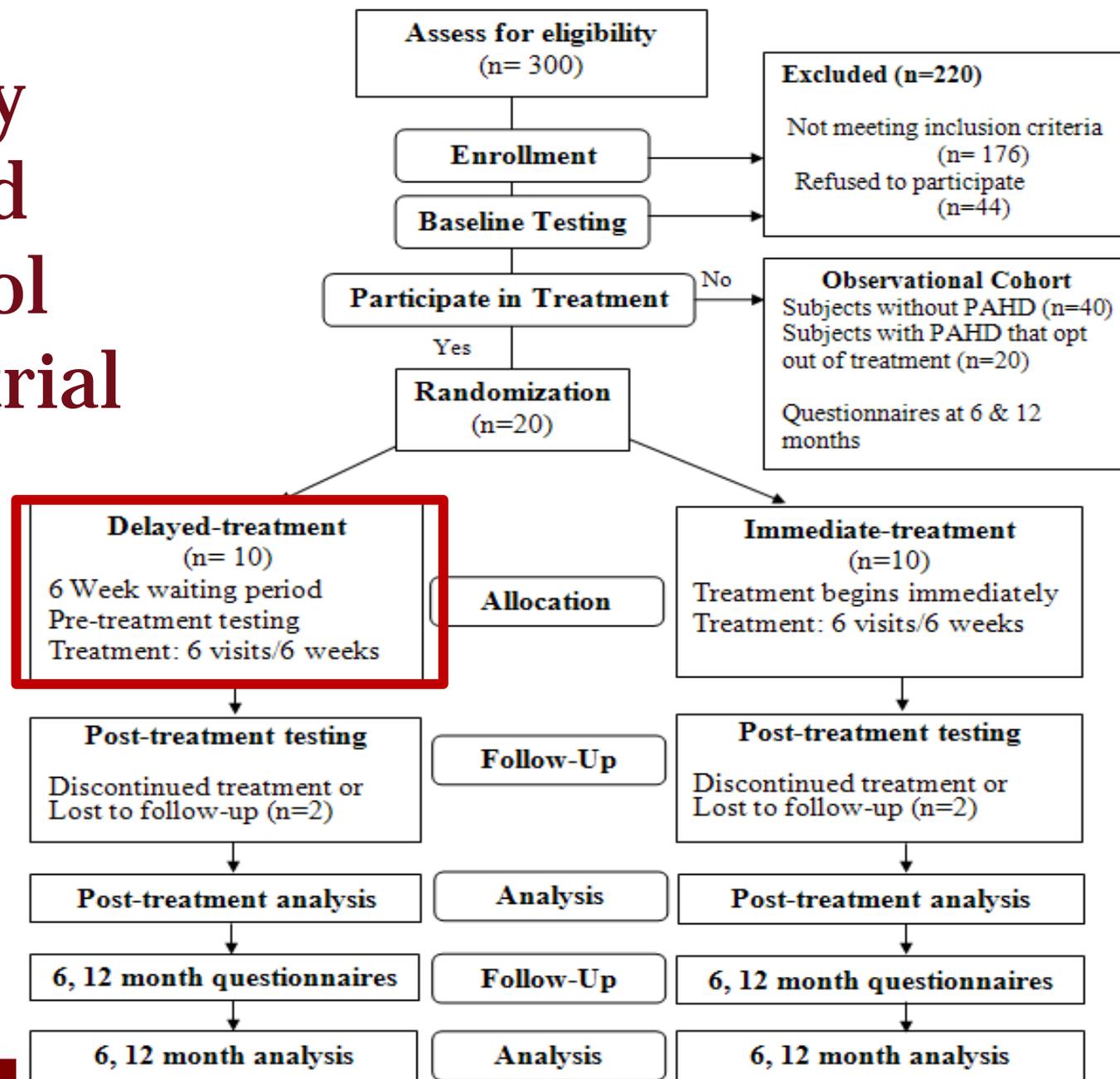


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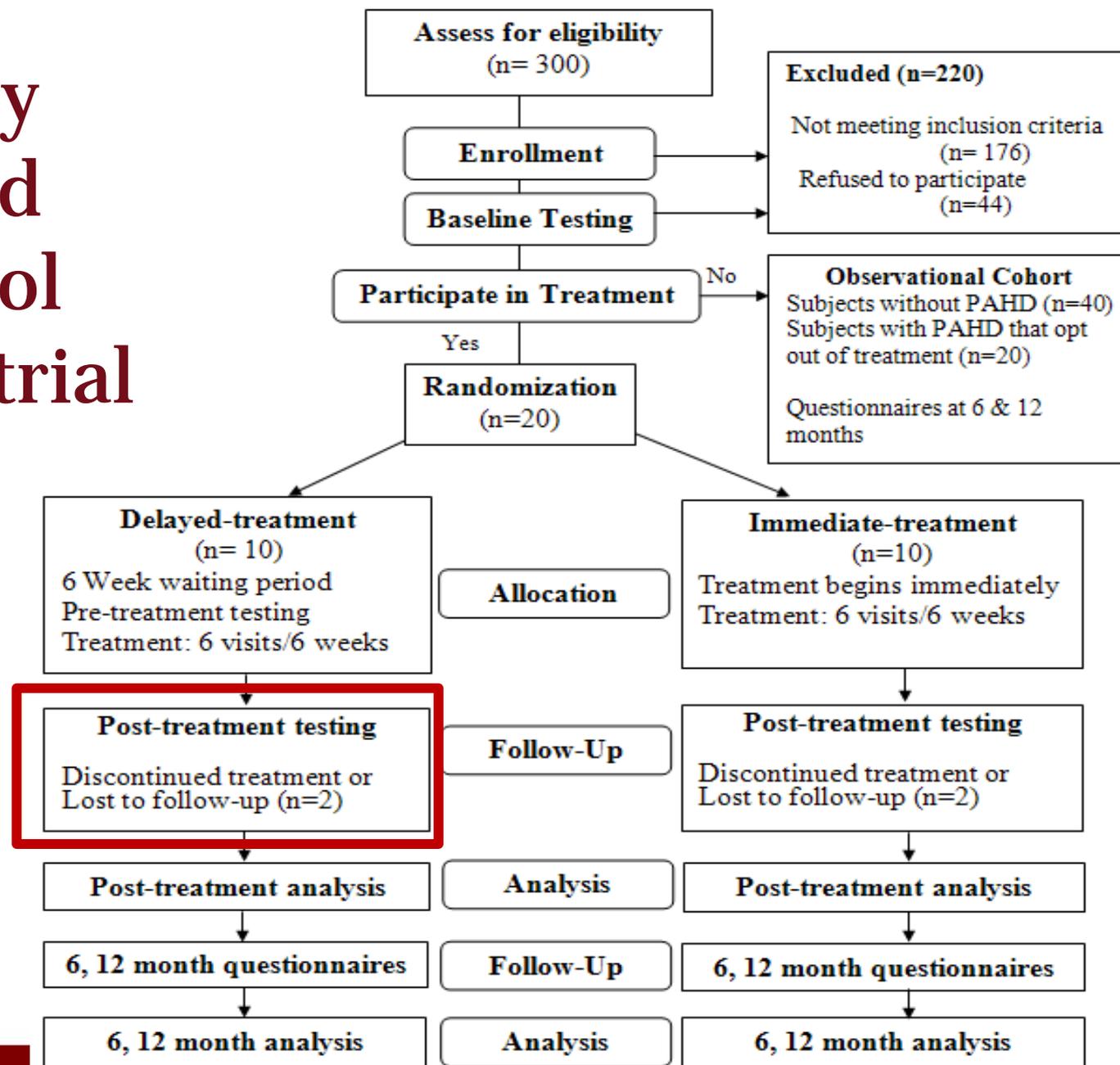


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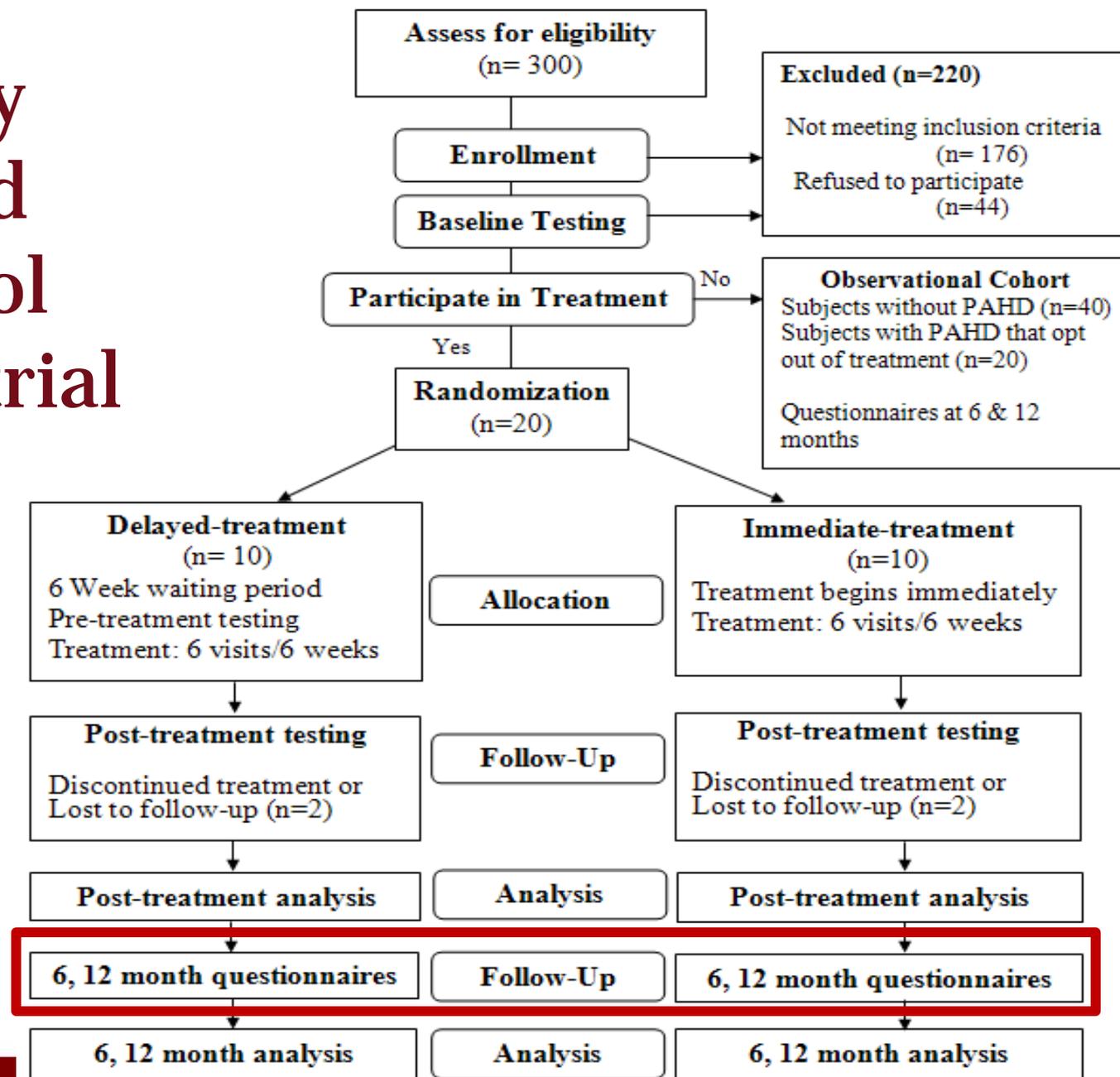


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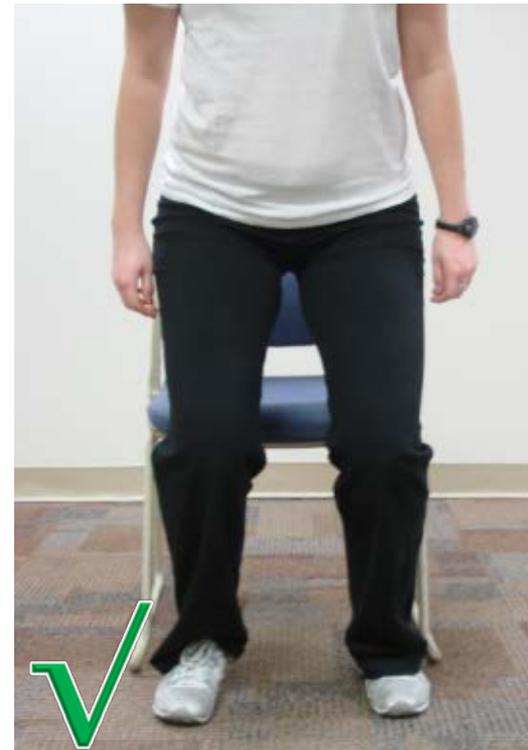
Movement Pattern Training Both Groups

- 6 – 1 hour sessions over 6 weeks
- Assessment and instruction in home program
 - Modifying abnormal movement patterns
 - Functional activities (sit to stand, walking)
 - Patient-specific activities (work, fitness)
- Hip muscle strengthening
 - Hip abductors
 - Hip external rotators
 - Hip flexors



Modifying movement patterns

Daily activities – Sit to Stand





Modifying movement patterns

Daily activities - Sitting





Modifying movement patterns

Daily activities - Sleeping





Modifying movement patterns

Higher level activities

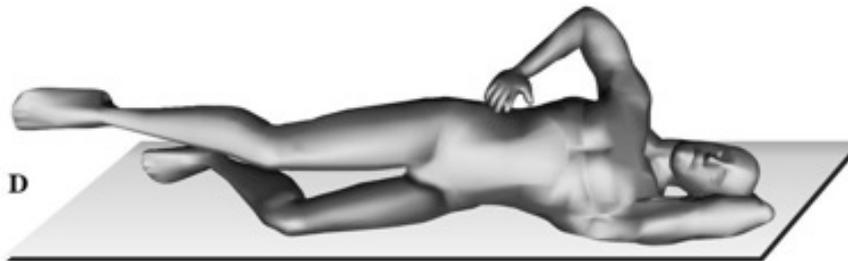
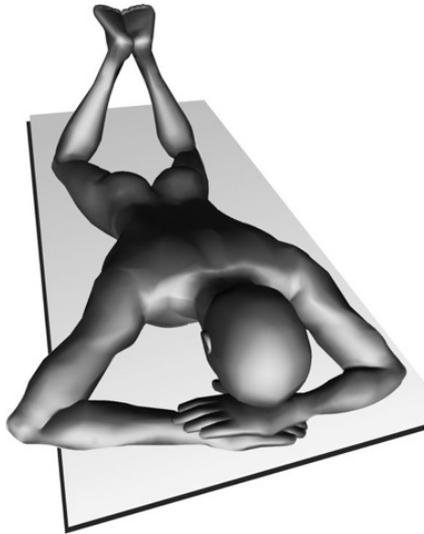




Movement Pattern Training

- 6 – 1 hour sessions over 6 weeks
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Muscle Strengthening Hip External Rotation (extension)

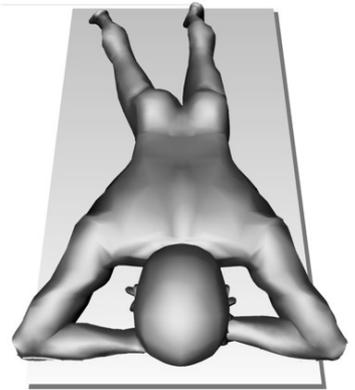
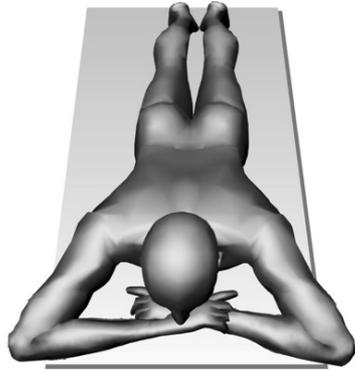


Easiest

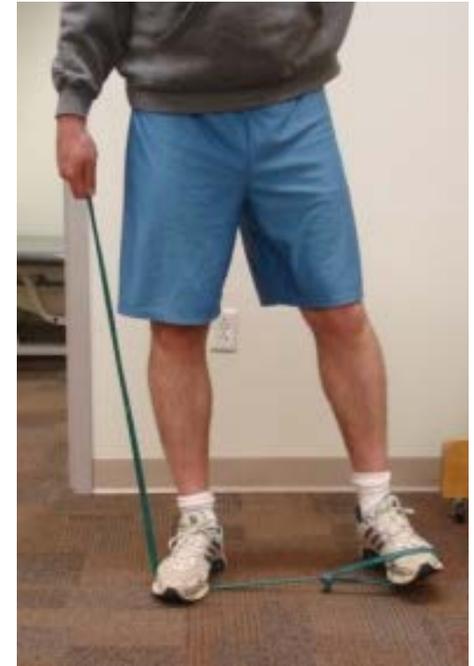
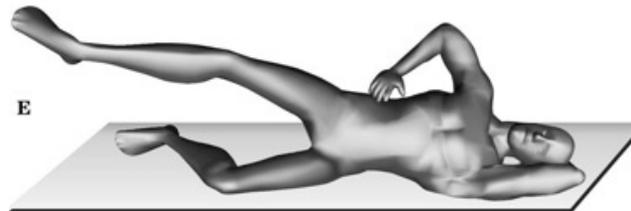
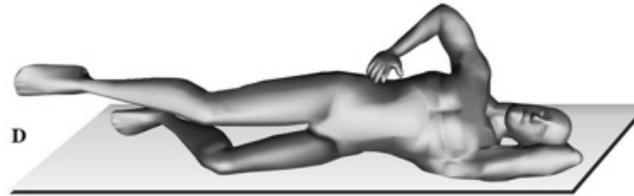
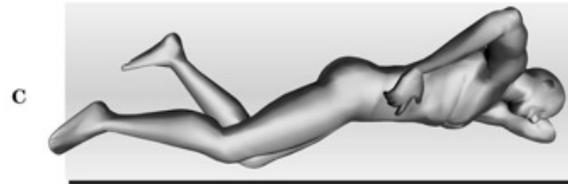


Hardest

Muscle Strengthening Hip Abductors



Easiest



Hardest



Progression Table of Hip Strengthening Exercises to be performed 2/day

Target muscle	Level 1	Level 2	Level 3	Level 4	Level 5
1. Hip external rotators with the hip in extension	1. Isometric hip ER ^a in prone with knees flexed. - 10-20 reps, 2 sets	1. Hip ER in standing - 10-20 reps, 2 sets	1. Hip ER in side lying with hip extended - 10-20 reps, 2 sets	1. Hip ER in standing with theraband - 10-20 reps, 2 sets	1. Hip ER in standing; progress theraband resistance - 10-20 reps, 2 sets
2. Improve hip flexion motion.	2. Quadruped rocking - 10 reps, 2 sets	2. Quadruped rocking - 10 reps, 2 sets	2. Quadruped rocking - 10 reps, 2 sets	2. Quadruped rocking - 10 reps, 2 sets	2. Quadruped rocking - 10 reps, 2 sets
3. Hip external rotators with the hip in flexion	3. Isometric hip ER in sitting - 10-20 reps, 2 sets	3. Hip ER in sitting - 10-20 reps, 2 sets	3. Hip ER in sitting; with theraband resistance - 10-20 reps, 2 sets	3. Partial squats with theraband at distal femur - 10-20 reps, 2 sets	3. Side stepping while in squat position; theraband at distal femur or ankle - 10-20 reps, 2 sets
4. Hip flexors	4. Active-assist hip flexion in sitting - 10 reps, 2 sets	4. Place and Hold hip flexion in sitting - 10 reps, 2 sets	4. Isometric at end-range flexion in sitting - 10 reps, 2 sets	4. Active hip flexion in sitting - 10 reps, 2 sets	4. Hip flexion in sitting with theraband - 10 reps, 2 sets
5. Hip abductors	5. Hip Abd ^b in prone - 10-20 reps, 2 sets	5. Hip Abd in standing - 10-20 reps, 2 sets	5. Hip Abd in side lying with hip extended - 10-20 reps, 2 sets	5. Hip Abd in standing with theraband - 10-20 reps, 2 sets	5. Hip Abd in standing; progress theraband resistance - 10-20 reps, 2 sets
6. Combined hip external rotators and abductor strengthening in functional position	6. Bilateral, isometric gluteal contraction in standing - 10-20 reps, 2 sets	6. <u>Weight</u> shifting with unilateral gluteal contraction on the stance limb. - 10-20 reps, 2 sets	6. Single leg stance - 10-20 reps, 2 sets	6. Hip ER with Abd in standing with theraband - 10-20 reps, 2 sets	6. Hip ER with Abd in standing; progress theraband resistance - 10-20 reps, 2 sets

ER = External rotation, ^aAbd = Abduction

Independence Assessment Exercise

EXERCISE PROGRESS TABLE
Exercises for Hip Strengthening

Exercise	Reviewed Key Concept	Compliance Assessment					Date/ Visit Exercise Initiated (color theraband if approp)	# Reps Given & # Times per Day <u>Reps</u> <u>Times</u>		Status of Exercise (P, O, T) ¹	Comments
		Knowledge of Key Concept		Performance							
		Yes	No	I	VC ²	VC/PA ²					
Hip ER (ext)											
1. Prone isom (feel in seat muscles)											
2. Stand, rotate on heel (don't rotate pelvis, feel in seat) 											
3. Side lying (don't rotate pelvis, feel in seat) 											
4. Stand w/ resist (don't rotate/tilt pelvis, feel in seat) 						Tband_____					
5. Stand progress resist (don't rotate/tilt pelvis, feel in seat)						Tband_____					

ER = External rotation, Abd = Abduction, Flex = Flexion, VC = verbal cues. ²PA = physical assistance; ¹P = progressed to a higher level of exercise; (different exercise); O = ongoing and independent; T = terminated because too difficult, status worsened or exercise is no longer to be performed. Patient is progressed to the next level of exercise when they can perform 2 sets of 20 repetitions independently and with ease.

Independence Assessment Functional Activities

PROGRESS TABLE
 Modification of Functional Activities

		Independence Assessment					Progress Notes		
Activity	Reviewed Key Concept	Knowledge of Key Concept		Performance			Date/ Visit Activity Initiated	# Reps (if given)	Comments
		Yes	No	I	VC ¹	VC/ PA ²			
Required:*									
1. Standing: (Avoid swayed position, keep knees unlocked and equal weight-bearing)									
2. Sit to stand (Slide to the edge, keep knee in line with 2 nd toe; don't allow the knees to roll in)									
3. Walking (Contract the gluteals on the stance limb; don't let your knee roll in or pelvis tilt, lift heel early)									
4. Sitting (limit time sitting, hips higher than knees, feet support and relaxed, do not cross legs)									
5. Sleeping position (Avoid extreme hip flexion or rotation. Side lying - pillow between knees; Supine - pillows under knees)									
6. Single Leg Squat (Contract the gluteals on the stance limb; don't let the knee roll in or trunk lean)									

¹VC = verbal cues. ²PA = physical assistance. *Required activities = must prescribe irrespective of symptoms. ³Options for other activities = if helps attain relief and feasible to perform. ⁴Activities patient specifically reports are symptom provoking or difficult due to pain. ⁵Patient specific options obtained from Modified Harris Hip Score, Hip Outcome Score or patient report during history. If item is highlighted, a related activity or position was symptomatic on examination and treatment specific to this item should be initiated.

*Progress table adapted from Van Dillen study (R01HD047709-02). Methods for determining patient independence is outlined in Harris-Hayes M et al. Development and Preliminary Reliability Testing of an Assessment of Patient Independence in Performing a Treatment Program: Standardized Scenarios. *Journal of Rehabilitation Medicine* 2010. Rehab Protocol V.2 20100909



Self-Report Adherence

R01 HD047709,
Van Dillen LR (PI)

Name _____ Subject Code: _____

Date: _____

Functional Activities and Exercise Log - Weekly

- This questionnaire is designed to provide your therapist with information about how often you are able to perform the treatments you were given.
- Your therapist understands that you are busy and that it may be difficult to do all of your functional activity modifications and exercises.
- It is very important that you give a **true picture** of what you actually have been able to do. Your answer should **not** be based on what you think you should have done.
- Please indicate for the **past week** how much of the exercises and functional activity modifications you were able to do.
- Please answer the questions by **circling** the percentage that best represents what you did.

Over the past week, what percentage of your **functional activities as instructed by your physical therapist** did you perform?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Over the past week, what percentage of your **prescribed exercises** did you perform?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

On average, how many times per day are you able to complete your exercise program?

0 1 2 >2

Primary Outcome

- Modified Harris Hip Score
 - Hip-specific patient reported outcome
 - Questions
 - Pain
 - Functional ability
 - Percentage score
 - 100 = no disability

Participant code _____

Date _____
month/day/year

1.4 Modified Harris Hip Score

For each category, check the box that best describes you: (Please check only one box.)

1. Which of these categories would best describe your hip pain?

- ₁ None/Able to ignore it
- ₂ Slight, occasional, no compromise in activity
- ₃ Mild, no effect on ordinary activity, pain after unusual activity, use aspirin/ibuprofen/Tylenol
- ₄ Moderate, tolerable, make concessions, occasional pain reliever stronger than aspirin or Tylenol
- ₅ Marked, serious limitations
- ₆ Totally disabled

2. Functional capacity (Please check only one box for each question below.)

a. How much do you limp while walking?

- ₁ None
- ₂ Slight
- ₃ Moderate
- ₄ Severe
- ₅ Unable to walk

d. How do you go up and down stairs?

- ₁ Normally (1 foot on each step)
- ₂ Normally with banister
- ₃ Any method (Both feet on each step)
- ₄ Not able

b. Do you need support when walking?

- ₁ None
- ₂ Cane for long walks
- ₃ Cane all the time
- ₄ Crutch
- ₅ 2 Canes
- ₆ 2 Crutches
- ₇ Walker
- ₈ Unable to walk

e. How do you put on shoes and socks?

- ₁ With ease
- ₂ With difficulty
- ₃ Unable

f. How long can you sit in a chair?

- ₁ Any chair, 1 hour
- ₂ High chair, ½ hour
- ₃ Unable to sit in any chair ½ hour

g. How far can you walk without stopping because of hip pain?

- ₁ Unlimited
- ₂ 6 Blocks
- ₃ 2-3 Blocks
- ₄ Indoors only
- ₅ Bed and chair only

g. Are you able to use public transportation such as a bus or subway if you wanted to?

- ₁ Able to use
- ₂ Unable to use



PRELIMINARY RESULTS TREATMENT

Demographics

Variable Mean (SD)	n=16
Sex	14F:2M
Age (yrs)	27.2 (5.4)
BMI (kg/m²)	24.3 (2.4)
UCLA 10 = higher activity level	8.2 (2.0)
Pain duration (yrs)	2.7 _± 3
MHHS (%) 100% = no disability	82.1 _± 10.2
Pain (worst last week) 10 = worst imaginable	5.9 (2.4)

Demographics

Variable	n=16
Mean (SD)	
Sex	14F:2M
Age (yrs)	27.2 (5.4)
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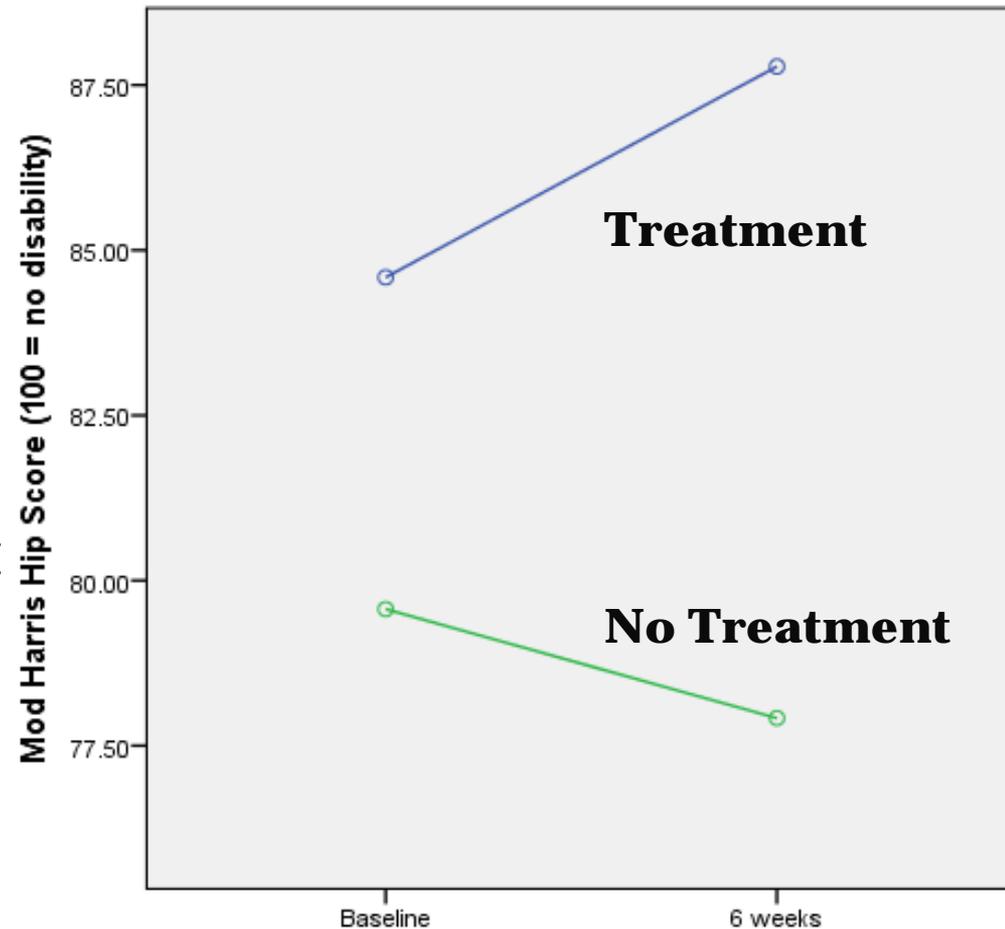
Pain duration (yrs) 2.7+3
 10 = Regularly participates in *impact* sports
MHHS (%) 82.1+10.2
 9 = Sometimes participates in *impact* sports
 100% = no disability
 8 = Regularly participates in *very active* events
Pain?

Demographics

Variable Mean (SD)	n=16
Sex	14F:2M
Age (yrs)	27.2 (5.4)
BMI (kg/m²)	24.3 (2.4)
UCLA 10 = higher activity level	8.2 (2.0)
Pain duration (yrs)	2.7 _± 3
MHHS (%) 100% = no disability	82.1 _± 10.2
Pain (worst last week) 10 = worst imaginable	5.9 (2.4)

Preliminary Comparison Immediate vs. Delayed

- Immediate (Treatment)
n = 10
- Delayed (No Treatment)
n = 6/8
-2 did not return for
pretreatment testing or
participate in treatment





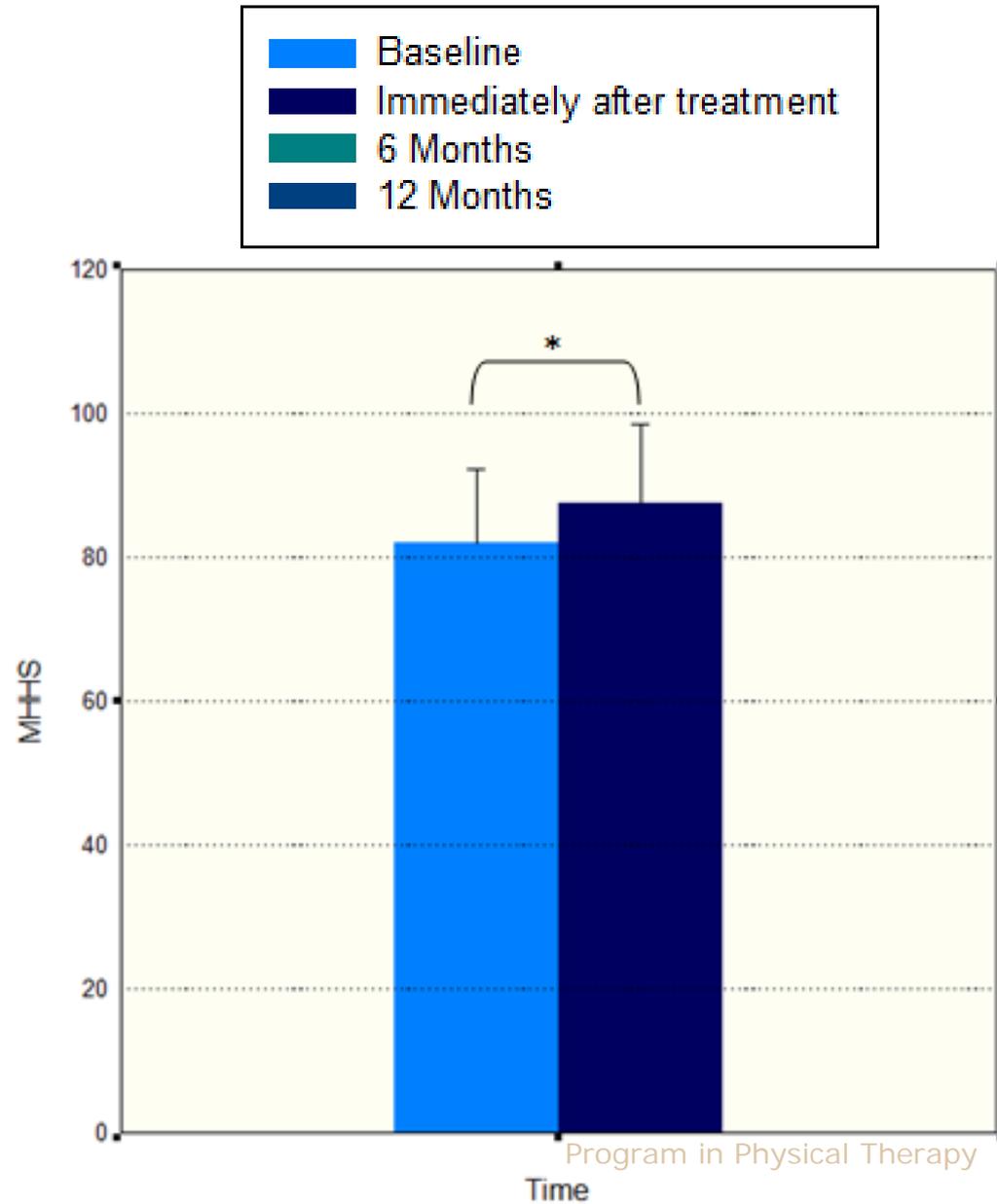
Descriptive Analysis – All subjects

- **Comparison to Baseline**
 - Immediately after treatment: n = 16
 - 6 months after treatment: n = 9
 - 12 months after treatment: n = 5
- **Repeated-measures ANOVA**
- **Bonferroni adjustment**
- **p value <.05**

Patient-Reported Outcomes

Compared to baseline, participants reported improvement in MHHS after treatment

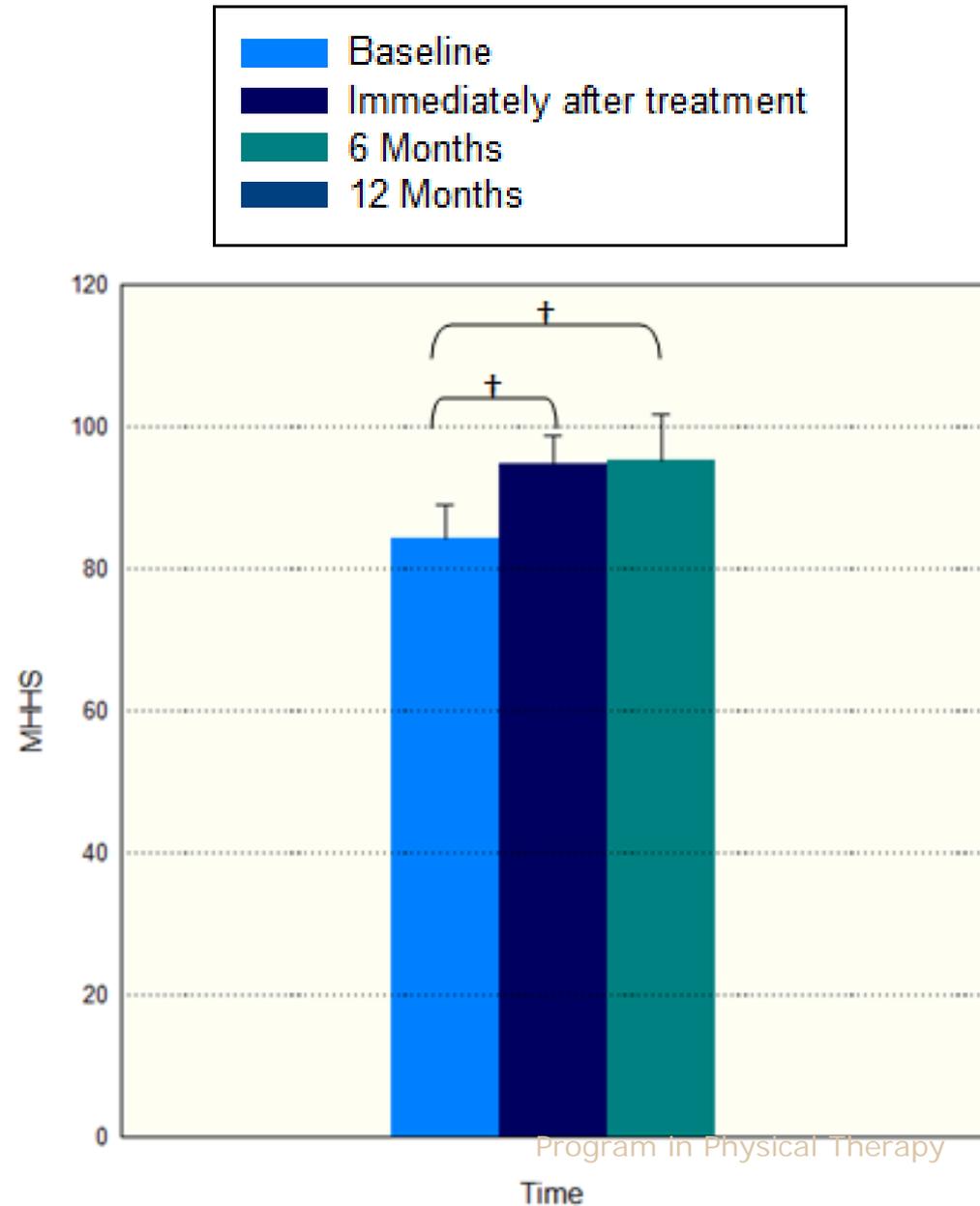
- 5.5% immediate (n=16)



Patient-Reported Outcomes

Compared to baseline, participants reported improvement in MHHS after treatment

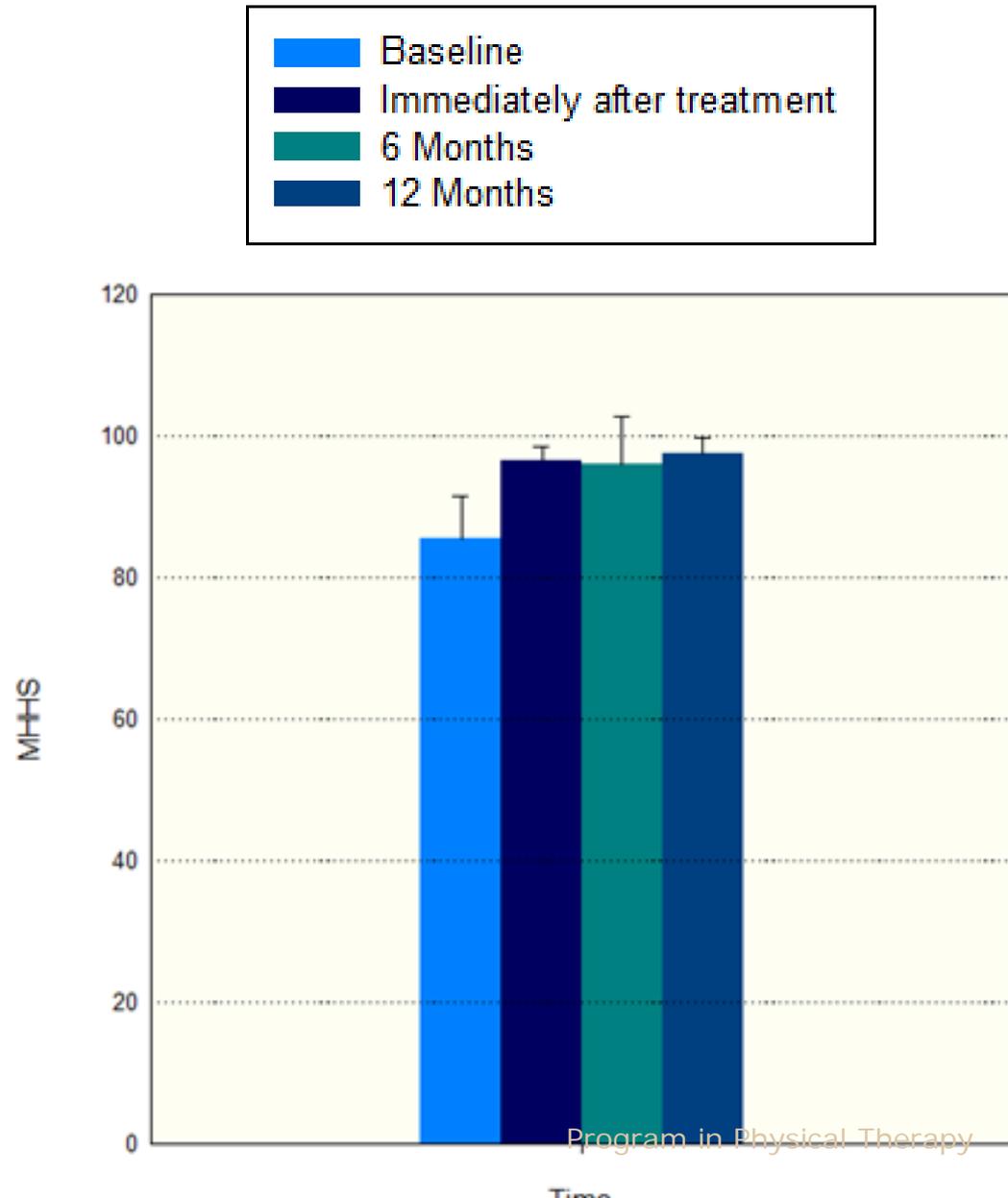
- 5.5% immediate (n=16)
- 10.5% immediate (n=9)
- 10.6% at 6 months (n=9)



Patient-Reported Outcomes

Compared to baseline, participants reported improvement in MHHS after treatment

- 5.5% immediate (n=16)
- 10.5% immediate (n=9)
- 10.6% at 6 months (n=9)
- 11% immediate (n=5)
- 10.6% at 6 months (n=5)
- 11.9% at 12 months (n=5)





Conclusion

- Preliminary results suggest movement pattern training may improve pain and function in patients with PAHD.
- Improvements may be maintained at 6 and 12 months after treatment.



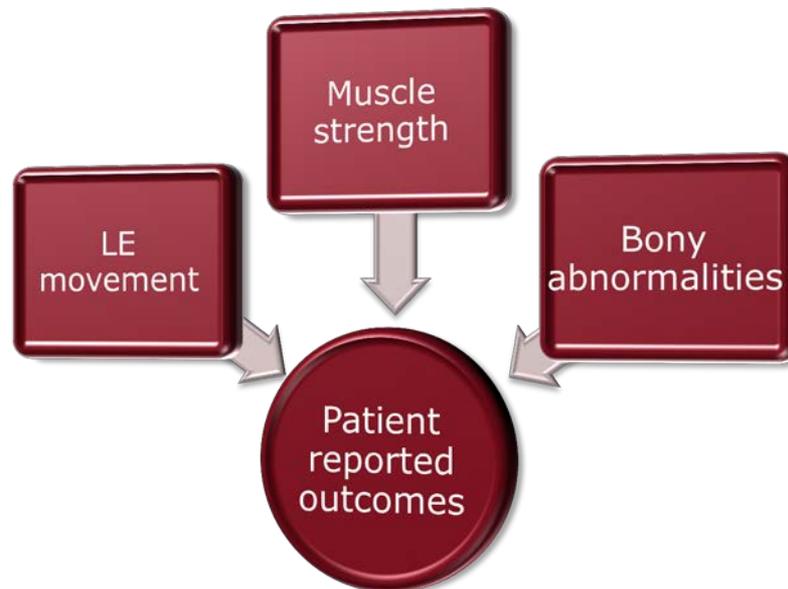
Our Future Research

- **Continue recruitment**
 - Target sample 40 per group (controls, PAHD)
 - Increase male participants

- **Comparison between PAHD and Controls**
 - Lower extremity (LE) movement patterns
 - Hip abductor and external rotator strength
 - Bony abnormalities

Our Future Research

- Future analyses to inform future clinical trials needed to assess the effectiveness of rehabilitation in people with PAHD.
 - Investigate relationships among strength, movement patterns, bony abnormalities and patient-reported outcomes.





Contributors

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