HIP PERIACETABULAR OSTEOTOMY POST-OPERATIVE GUIDELINE

The following Periacetabular Osteotomy guideline was developed by HSS Rehabilitation. Progression is both criteria-based and patient specific. Phases and time frames are designed to give the clinician a general sense of progression. The rehabilitation program following a Periacetabular Osteotomy must be tailored to the surgical procedure(s) performed, considering tissue and bone healing properties as well as neuromuscular re-education in the setting of new bony alignment. The program is developed to balance healing with gentle restoration of hip range of motion, muscular balance and stability. Special attention should be given to not irritate the psoas muscle during patient education of activities of daily living and therapeutic exercise.

FOLLOW SURGEON'S MODIFICATIONS AS PRESCRIBED

HIP PERIACETABULAR OSTEOTOMY POST-OPERATIVE GUIDELINE

Pre-operative Phase

PRECAUTIONS

- Avoid pain with daily activities and therapeutic exercise
- No active hip flexion with a long lever arm, such as straight leg raise (SLR) flexion
- Modify or minimize activities that increase symptoms

ASSESSMENT

- Lower Extremity Functional Scale (LEFS)
- Numeric pain rating scale (NPRS)
- Sensory motor screening
- Lower extremity (LE) active range of motion (AROM) and passive range of motion (PROM)
- Thoracic and lumbar spine AROM
- Deep abdominal and LE strength
- LE flexibility
- Gait
- Current activity level and post-operative goals
- Understanding of post-operative plan of care and current home exercise program (HEP)

TREATMENT RECOMMENDATIONS

- Patient education
    - Post-operative plan of care
    - Gait training with post-operative assistive device (AD) and weight-bearing (WB) status
    - Activity modifications/limitations
    - Body mechanics
    - Bed mobility
    - Transfer training
- HEP:
    - Focus on hip abductor/extensor and core strengthening with lumbopelvic stability through functional movement patterns
- Cryotherapy

GOALS FOR PRE-OPERATIVE PHASE

- Pain controlled with daily activity and therapeutic exercise
- Understanding of post-operative plan and activity modifications
- Independent with HEP

EMPHASIZE

- Familiarization with post-operative plan of care
- Improving deep abdominal and hip muscle activation for lumbopelvic stability during functional activities
- Symptom management

HIP PERIACETABULAR OSTEOTOMY POST-OPERATIVE GUIDELINE

Post-Operative Phase 1: Day 1 - Week 6

PRECAUTIONS

- Avoid irritation of the anterior hip structures
- Avoid prolonged standing and walking to fatigue
- Avoid pivoting or rotating on the operated leg during ambulation
- Avoid prolonged sitting with hips flexed to 90° or greater
- Avoid pain with activities of daily living (ADLs) and therapeutic exercise
- No active hip flexion with a long lever arm, such as SLR flexion
- Foot flat weight-bearing (FFWB) 20% body weight (BW) for the first 6 weeks
- No open chain isolated hip muscle activation, unless isometric

ASSESSMENT

- LEFS
- NPRS
- Incision status
- Sensory motor screening
- LE PROM, as appropriate
- Deep abdominal and LE strength, as appropriate
- Gait mechanics with appropriate AD
- Functional status
- Understanding of precautions, cryotherapy and HEP

TREATMENT RECOMMENDATIONS

- Patient education
    - Precautions and activity modification
    - HEP
- Bed mobility
- Transfer training
- Gait training on level surfaces and stairs with appropriate AD
    - FFWB 20% BW for first 6 weeks
- Cryotherapy

- HEP (0-4 weeks)
    - Hooklying abdominal bracing
    - Prone abdominal brace with gluteal isometrics (pillow under hips)
    - Quadriceps set (towel under knee)
    - Ankle pumps
- HEP (4-6 weeks)
    - Abdominal brace with shoulder flexion, progress to weighted
    - Hooklying hip external rotation isometric with resistance band (as tolerated)
    - Supine hip abduction isometric with resistance band (as tolerated)
    - Bridge progression: no resistance band to resistance band around knees
    - Prone abdominal brace with gluteal isometrics (pillow under hips)
    - Reclined long arc quads (LAQ)
    - Upright stationary bike (4 weeks) with light resistance
    - Forward walking in chest high water, as available

CRITERIA FOR ADVANCEMENT

- Pain controlled with daily activity and therapeutic exercise
- Normalized gait pattern with appropriate AD
- Independent with HEP
- Advance to weight bearing as tolerated (WBAT) per surgeon orders after 6-week follow up and review of radiographs (dependent on bone healing)
- Start outpatient physical therapy at 6 weeks post-operative

EMPHASIZE

- Protection of surgical site
- Avoiding symptom provocation
- Weight-bearing status
- Independent transfers
- Patient compliance with activity modification and HEP

HIP PERIACETABULAR OSTEOTOMY POST-OPERATIVE GUIDELINE

Post-Operative Phase 2: Weeks 7-12

PRECAUTIONS

- Avoid irritation of anterior hip structures
- Avoid prolonged standing and walking to fatigue
- Avoid pain with ADLs and therapeutic exercise
- No active hip flexion with a long lever arm, such as SLR flexion
- Avoid premature progression of WB status and discharge of AD
- Avoid faulty movement patterns and postures

ASSESSMENT

- LEFS
- International Hip Outcomes Tool (iHOT-12)
- NPRS
- Sensory motor screening
- LE AROM and PROM
- Thoracic and lumbar spine AROM
- LE and deep abdominal strength, as appropriate
    - Use hand-held dynamometer (HHD), if available
- LE flexibility, if appropriate
- Gait
- Balance
- Functional movement patterns and postures
- Current activity level
- Understanding of precautions and HEP

TREATMENT RECOMMENDATIONS

- Patient education
    - Precautions
    - Graded progression of ADLs and community ambulation
    - Monitor response to increased activity level
    - HEP
- Weight-bearing progression, upon surgeon clearance at 6 week follow-up
    - Week 6-7 WBAT with bilateral axillary crutches
    - Weeks 7-9 progress to 1 crutch for indoor activity and short community distances, with normalized gait mechanics
    - Weeks 9-10 progress to no crutches indoors and 1 crutch outdoors, with normalized gait mechanics

    - Weeks 10-12 progress to no crutches for household and short community ambulation, with normalized gait mechanics
- Hip PROM and AROM, as tolerated
    - Quadruped rocking
    - AROM (prone rotations) for hip external rotation (ER) and hip internal rotation (IR)
- Flexibility and mobility exercises
    - 1 and 2 joint hip flexors
    - Hamstrings
    - Gastrocnemius/soleus
    - Foam rolling to entire LE
- Soft tissue mobilization, as indicated
    - Psoas, adductors, tensor fascia lata (TFL), glute medius, glute maximus and piriformis
- Strengthening
    - Focus on hip and core activation and neuromuscular control
        - Hip abduction, ER and extension
            - Progress from isometrics to open and closed chain strengthening
        - Bridge progression: double to single leg
        - Deep abdominal strength progression: hooklying to quadruped to standing
            - Pelvic tilts
            - Bent knee fall outs (BKFO)
            - Quadruped abdominal bracing (bird dog arms only)
            - Pallof press
        - Plank progression
            - Modified front and side plank
- Balance/proprioception
    - Weight shifts
    - Progress from double limb support to single limb support (different surfaces)
    - Single leg (SL) balance progression
    - Balance board
- Functional strengthening
    - Leg press progression: double leg to eccentric to single leg
    - Squat: hip hinge initiation
    - Forward step down (FSD) progression
    - Forward step up (FSU) progression
- Cardiovascular fitness
    - Stationary bicycle
    - Swimming (arms with pull buoy only)
- Aquatic therapy, as appropriate
- Cryotherapy
- Progressive HEP

CRITERIA FOR ADVANCEMENT

- Pain free with ADLs and therapeutic exercise
- Normalized gait pattern without AD
- Normalized functional movement patterns and postures
- Hip ROM within functional limits
- SL stance without deviation for 30 seconds
- Ascend/descend 6-8” step with good mechanics and control
- Independent with HEP

EMPHASIZE

- Avoiding symptom provocation
- Lumbopelvic neuromuscular re-education and strengthening
    - Specific attention should be given to hip abduction and hip extension strengthening
- Normalized gait mechanics
- Normalized functional movement patterns
- Protection from hip flexor irritation
- Patient compliance with activity modification and HEP

HIP PERIACETABULAR OSTEOTOMY POST-OPERATIVE GUIDELINE

Post-Operative Phase 3: Weeks 13-24

PRECAUTIONS

- Avoid irritation of anterior hip structures
- Avoid pain with daily activities and therapeutic exercise
- Avoid faulty movement patterns and postures
- Pay attention to functional progression and cardiovascular fitness

ASSESSMENT

- LEFS
- iHOT-12
- NPRS
- LE PROM and AROM
- Thoracic and lumbar spine AROM
- LE and deep abdominal strength
    - Use HHD, if available
- LE flexibility
- Gait
- Balance
- Functional movement patterns and postures
- Current activity level
- Understanding and compliance of HEP

TREATMENT RECOMMENDATIONS

- Patient education
    - Monitoring response to increased activity intensity and volume
    - HEP
- Strengthening: hip and core, address any continued impairments
    - Lateral band walk progression
    - Clocks/three-point taps
    - Front and side plank progressions
    - Quadruped hip extension progress to bird dog
- Balance/proprioception
    - Single leg balance progression
    - Perturbation training

- Functional movements
    - Squat progression: staggered stance to single leg
    - Step down progression
    - Step up progression
    - Romanian dead lift (RDL): double leg to single leg
    - Lunges: static to dynamic
    - Chops/lifts: varied positions
    - Pallof press rotations
- Cardiovascular fitness
    - Stationary bicycle
    - Elliptical
    - Swimming
- Flexibility exercise continuation, as indicated
- Soft tissue mobilization continuation, as indicated
- Aquatic therapy, as indicated
- Initiate gym program and progress HEP

CRITERIA FOR ADVANCEMENT

- Pain free with ADLs and therapeutic exercise
- Normalized functional movement patterns
- Hip strength on dynamometry within 20% of uninvolved side or 5/5 strength with manual muscle testing (MMT)
- Single leg bridge with good pelvic stability, control and gluteal activation
- Descend 8” stair with good control and mechanics
- Perform a single limb RDL with good control and lumbopelvic stability
- Full ROM and flexibility to meet demands of activities
- Independent with HEP

EMPHASIZE

- Avoiding symptom provocation
- Normalized functional movement patterns and postures
- Functional strength and endurance progressions
- Protection from anterior hip irritation
- Patient compliance with activity modification and HEP

HIP PERIACETABULAR OSTEOTOMY POST-OPERATIVE GUIDELINE

Post-Operative Phase 4: Months 6-9

PRECAUTIONS

- Avoid hip flexor and capsular irritation
- Avoid pain with ADLs and therapeutic exercise
- Avoid faulty movement patterns and postures
- Avoid drastic changes in volume or intensity of functional progression and cardiovascular fitness

ASSESSMENT

- LEFS
- iHOT-12
- NPRS
- LE PROM and AROM
- Thoracic and lumbar spine AROM
- LE and deep abdominal strength
    - Use dynamometry, if available
- LE flexibility
- Gait
- Balance
- Functional movement patterns and postures:
    - Single leg stance
    - Single leg bridge
    - Single leg squat
    - Forward step down
    - Single leg RDL
- Current activity level
- Understanding of precautions and HEP

TREATMENT RECOMMENDATIONS

- **Special consideration:**
  - Removal of hardware (ROH) may occur during 6-9 month timeframe
  - Physical therapy to resume 4 weeks following ROH
  - No impact loading for 6 weeks following ROH pending full strength return
- Patient education
  - Monitoring response to increased activity, intensity, and volume
  - HEP
- Continue to address any functional ROM, flexibility, strength, endurance and motor control deficits
- Functional and activity specific balance/proprioception progressions
  - Kinetic chain linking
- Cardiovascular fitness to meet demands of activity
  - Stationary bicycle
  - Elliptical
  - Swimming
- Return to running initiation and progression, upon surgeon clearance
  - Anti-gravity treadmill, if available
  - Run-walk intervals
  - Gradually build volume before intensity
- Plyometric and agility initiation and progressions
  - Bilateral to unilateral
  - Multi-direction motions
- Soft tissue mobilization, as indicated
- Independent gym program progression with HEP integration

CRITERIA FOR DISCHARGE OR ADVANCEMENT TO PHASE 5 IF RETURNING TO PLAY

- Pain free with ADLs and therapeutic exercise
- Normalized functional movement patterns and postures to meet the demands of daily and recreational activity
- Hip strength on dynamometry within 10% of uninvolved side or 5/5 strength with MMT
- Full ROM and flexibility
- Independent with HEP and gym program

EMPHASIZE

- Quality of movement
- Functional progression
- SL strength

HIP PERIACETABULAR OSTEOTOMY POST-OPERATIVE GUIDELINE

Post-Operative Phase 5: 9+ Months

PRECAUTIONS

- Avoid hip flexor and capsular irritation
- Avoid pain with ADLs and exercise
- Avoid faulty movement patterns and postures
- Gradual return to activity participation with load and volume monitoring under guidance of physical therapist, referring surgeon, athletic trainer (ATC) and coach

ASSESSMENT

- LEFS
- iHOT-12
- NPRS
- LE PROM and AROM
- Thoracic and lumbar spine AROM
- LE and deep abdominal strength
    - Use dynamometry, if available
- LE flexibility
- Balance
- Functional assessment
- Current activity level
- Understanding of precautions and HEP

TREATMENT RECOMMENDATIONS

- Patient education
    - Graded return to activity/participation/competition upon clearance by surgeon following return to sport testing
    - Monitoring response to increased activity level
    - HEP/gym program
- Functional strengthening in activity specific movement patterns
- Agility exercises to address sport specific demands
- Plyometric progression to advanced movements
- Cardiovascular fitness to match demands of activity
    - Indoor/outdoor high intensity cycling
    - Elliptical
    - Running speed and volume progression
    - Unrestricted swimming

- Flexibility exercises, as indicated
- Performance training initiation, as appropriate
- Consult with referring surgeon on return to sport timing, recommendations, and/or limitations
- Collaborate with ATC, coaches and trainers to monitor load and volume as patient prepares for and initiates return to participation/competition

CRITERIA FOR DISCHARGE/RETURN TO SPORT

- Pain free
- Demonstrates movement patterns, functional strength, flexibility, motion, endurance, power, deceleration, and accuracy to meet the demands of sport
- Surgeon clearance for return to sport
- Independent with gym program and HEP

EMPHASIZE

- Avoiding symptom provocation
- Sport specific movement patterns, strength, endurance, accuracy and power
- Patient compliance with gym program and HEP
- Communication of expectations and progressions with referring surgeon, athletic trainer and coaching staff

HIP PERIACETABULAR OSTEOTOMY POST-OPERATIVE GUIDELINE

References

1. Adler KL, Cook PC, Geisler PR, Yen YM, Giordano BD. Current concepts in hip preservation surgery: part II— rehabilitation. *Sports Health*. 2016;8(1):57-64. doi:10.1177/1941738115577621.

2. Bishop BN, Greenstein J, Etnoyer-Slaski JL, Sterling H, Topp R. Electromyographic analysis of gluteus maximus, gluteus medius, and tensor fascia latae during therapeutic exercises with and without elastic resistance. *Int J Sports Phys Ther*. 2018;13(4):668-675. doi:10.26603/ijspt20180668.

3. Disantis AE, Ruh E, Martin R, Enseki K, McClincy M. Rehabilitation guidelines for use following a periacetabular osteotomy (PAO): a North American based delphi consensus. *Int J Sports Phys Ther.* 2022 Oct 2;17(6):1002-1015. doi: 10.26603/001c.38043. PMID: 36237641; PMCID: PMC9528724.

4. Domb B, Stake C, Finch N, Cramer T. Return to sport after hip arthroscopy: aggregate recommendations from high volume hip arthroscopy centers. *Orthopedics*. 2014;37:E902-E905.

5. Gahramanov A, İnanıcı F, Çağlar Ö, et al. Functional results in periacetabular osteotomy: Is it possible to obtain a normal gait after the surgery? *HIP Int*. 2017;27(5):449-454. doi:10.5301/hipint.5000494.

6. Ganderton C, Pizzari T, Cook J, Semciw A. Gluteus minimus and gluteus medius muscle activity during common rehabilitation exercises in healthy postmenopausal women. *J Orthop Sport Phys Ther*. 2017;47(12):914-922. doi:10.2519/jospt.2017.7229.

7. Gougoulias N, Khanna A, Maffulli N. Sports activities after lower limb osteotomy. *Br Med Bull*. 2009;91(1):111-121. doi:10.1093/bmb/ldp023.

8. Griffin VC, Everett T, Horsley IG. A comparison of hip adduction to abduction strength ratios, in the dominant and nondominant limb, of elite academy football players. *J Biomed Eng Informatics*. 2015;2(1):109. doi:10.5430/jbei.v2n1p109.

9. Harput G, Ulusoy B, Yildiz T, Cross-education improves quadriceps strength recovery after ACL reconstruction: a randomized controlled trial. *Knee Surg Sports Traumatol Arthrosc*. 2018 Jun 29. doi: 10.1007/s00167-018-5040-1

10. Heyworth B, Novais E, Murray K. Return to play after periacetabular osteotomy for treatment of acetabular dysplasia in adolescent and young adult athletes. *Am J Sports Med*. 2016 Jun;44(6):1573-81. doi: 10.1177/0363546516632743.

11. Ito H, Tanino H, Sato T, Nishida Y, Matsuno T. Early weight-bearing after periacetabular osteotomy leads to a high incidence of postoperative pelvic fractures. *BMC Musculoskelet Disord*. 2014;15(1):1-7. doi:10.1186/1471-2474- 15-234.

12. Jacobs C, Uhl TL, Seeley M, Sterling W, Goodrich L. Strength and fatigability of the dominant and nondominant hip abductors. *J Athl Train*. 2005;40:203-206.

13. Kamath AF. Bernese periacetabular osteotomy for hip dysplasia: surgical technique and indications. *World J Orthop*. 2016;7(5):280. doi:10.5312/wjo.v7.i5.280.

14. Kemp JL, Risberg MA, Schache AG, Makdissi M, Pritchard MG, Crossley KM. Patients with chondrolabral pathology have bilateral functional impairments 12 to 24 months after unilateral hip arthroscopy: a cross-sectional study. *J Orthop Sport Phys Ther*. 2016;46(11):947-956. doi:10.2519/jospt.2016.6577.

15. Klit J, Hartig-Andreasen C, Jacobsen S, Søballe K, Troelsen A. Periacetabular osteotomy: sporting, social and sexual activity 9-12 years post surgery. *HIP Int*. 2014;24(1):27-31. doi:10.5301/hipint.5000077,

16. Macadam P, Cronin J, Contreras B. An examination of the gluteal muscle activity associated with dynamic hip abduction and hip external rotation exercise: a systematic review. *Int J Sports Phys Ther*. 2015 Oct; 10(5):573–591.

17. Manca A, Dragone D, Dvir D, et.al. Cross-education of muscular strength following unilateral resistance training: a meta-analysis. *Eur J Appl Physiol*. 2017 Nov;117(11):2335-2354. doi: 10.1007/s00421-017-3720-z.

18. Mentiplay BF, Perraton LG, Bower KJ, et al. Assessment of lower limb muscle strength and power using hand-held and fixed dynamometry: A reliability and validity study. *PLoS One*. 2015;10(10):1-18. doi:10.1371/journal.pone.0140822.

19. Pogliacomi F, Stark A, Wallensten R. Periacetabular osteotomy: Good pain relief in symptomatic hip dysplasia, 32 patients followed for 4 years. *Acta Orthop Scand*. 2005;76(1):67-74. doi:10.1080/00016470510030346.

20. Shoenfeld B. The mechanisms of muscle hypertrophy and their application to resistance training. J *Strength Cond Res*. 2010 Oct;24(10):2857-72. doi: 10.1519/JSC.0b013e3181e840f3.

21. Steppacher SD, Tannast M, Ganz R, Siebenrock KA. Mean 20-year followup of Bernese periacetabular osteotomy. *Clin Orthop Relat Res*. 2008;466(7):1633-1644. doi:10.1007/s11999-008-0242-3.

22. Tippett SR. Returning to sports after periacetabular osteotomy for developmental dysplasia of the hip. *N Am J Sports Phys Ther*. 2006;1(1):32-39.

Created: 6/2020
Revised: 3/2022, 5/2024