Comprehensive Hip Preservation Packet

Dr. Sanjeev Bhatia, M.D.
Dear Patient,

Thank you for choosing Dr. Sanjeev Bhatia at Cincinnati SportsMedicine & Orthopaedic Center—Mercy Health (CSMOC) to address your medical needs. We are honored to be able to help you throughout your journey. It is important to know that you'll have a great deal of support & guidance throughout this process. Your team of specialists includes Dr. Bhatia, the Mercy Health and CSMOC staff, and your Physical Therapists. As an approved candidate for hip arthroscopy, Dr. Bhatia has confidence in your potential for success. Together, we will set realistic goals to get you to your desirable level of function. It is the mission of this team to work together with you to help you reach your goals.

You are the most crucial member of the team and your active participation is invaluable to the ultimate success of your surgery. Without your commitment to reach your goals and you providing feedback along the way, other team members cannot operate as effectively in their roles. We all rely on you to provide input on what you feel is working, what may not be beneficial, and how you are best motivated.

From our experience, you can expect a challenging yet rewarding road ahead. While no two patients are the same, all experience highs and lows along the way. We encourage you to build friendships with fellow patients while you are here, but caution you in comparing yourself or your progress with other patients. You have a unique medical history, injury, surgical procedure, body type, and goals, and your road to recovery will differ from others. The ultimate goal for everyone is to return to their pre-injury level and to stay there, not just how quickly you get there. This requires a progressive return that allows for complete healing of the repaired tissues and a re-balancing of all muscles involved.

We look forward to working with you and encourage you to play an active role in the process.

Sincerely,

Dr. Bhatia and our Mercy Health Team
IMPORTANT CONTACT PHONE NUMBERS

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Office Number: 513-347-9999 / 513-223-BONE
Administration / Questions: Aletha Kiner – (513) 985-1277
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Hip Anatomy

Joint opened: lateral view

- Anterior superior iliac spine
- Anterior inferior iliac spine
- Lliopubic eminence
- Acetabular labrum (fibrocartilaginous)
- Fat in acetabular fossa (covered by synovial membrane)
- Obturator artery
- Anterior branch
- Posterior branch
- Acetabular branch
- Obturator membrane
- Transverse acetabular ligament
- Ischial tuberosity
- Lesser trochanter
- Ligament of head of femur (cut)
- Intertrochanteric line
- Head of femur
- Neck of femur
- Greater trochanter
- Articular cartilage
- Lunate (articular) surface of acetabulum
• The labrum, because of its function in distributing weight-bearing forces, is susceptible to traumatic injury from shearing forces that occur with twisting, pivoting, and falling.
• Due to its nerve innervation, an isolated labral tear can result in pain.
• A majority of tears are located anterosuperiorly.
• Labral tears can cause micro-instability of the hip joint, leading to increased stresses between the femur and acetabulum.
• Instability can also lead to cartilage lesions and degeneration
• Cam impingement occurs when the femoral head has an abnormally large radius, with a loss of the normal spherical junction between the femoral head and neck.
• “Cam” refers to the cam effect caused by a nonspherical or abnormal femoral head (ball) rotating inside a normal acetabulum (socket).³
• This may occur as a sequelae of childhood disorders such as slipped capital femoral epiphysis (SCFE), but most commonly is attributed to eccentric closure of the femoral head growth plate during adolescence.
• This will lead to abnormal contact between the femoral head and acetabulum, especially with combined flexion, adduction and internal rotation, causing shear force on the anterolateral edge of the acetabular articular surface.
• With repetitive motion, this eventually results in articular delamination and failure of the acetabular articular cartilage.
• CAM impingement has been recognized as a cause of labral tears and cartilage lesions.
• Cam impingement has approximately a 3-to-1 predilection for males and problems often appear in young adulthood.
• A Pincer lesion refers to an abnormal acetabulum with increased overcoverage. Pincer impingement is caused by an abnormally deep or retroverted socket that bumps against a normal “ball” (femoral head/neck). This is opposed to CAM impingement, in which an abnormal “ball” (femoral head/neck) contacts a normal socket (acetabulum).
• The overcoverage can be general (coxa profunda) or local (acetabular retroversion).
• Pincer lesions cause persistent abutment of the femoral head into the acetabulum and can be a cause of posteriorinferior cartilage lesions.³
• This can occur from overgrowth of the anterior edge, or retroversion of the acetabulum, which is a condition in which the face of the acetabulum tilts slightly backward instead of its normal forward position.³
• With hip flexion, the prominent rim of the acetabulum impinges the labrum against the femoral neck.
• This repetitive microtrauma leads to breakdown and failure of the acetabular labrum.
• Pincer impingement occurs just about equally in males and females and more
Medical and Rehabilitation Definitions

**Acetabulum**: hip socket

**Anterior**: towards the front of the body

**AROM**: “active range of motion” = movement is performed by patient

**Closed Chain**: movement in which the end segment of the exercised limb is fixed to the ground. Ex. standing exercises, leg press

**Concentric**: contraction of a muscle as it is shortening. Ex. “upward phase” of a biceps curl

**Eccentric**: contraction of a muscle as it is lengthening. Ex. “lowering phase” of a biceps curl

**FAI**: femoral acetabular impingement

**Femur**: thigh bone

**Gait**: walking pattern

**Inflammation**: the body’s natural response to protect from infection and surgical trauma. Can cause swelling, heat, and pain.

**Isometric**: contraction of a muscle without movement

**Joint Mobs**: Joint mobilization is a type of passive movement of a skeletal joint. It is usually aimed at a 'target' synovial joint with the aim of decreasing joint stiffness or decreasing pain.

**Labrum**: a fibrocartilaginous rim extending off the acetabulum to deepen the socket and provide a suctioning effect

**Lateral**: further away from the body’s midline

**Medial**: towards the body’s midline

**Muscle Imbalances**: differences in strength or tightness in muscles on either side of the joint

**Muscle Inhibition**: “shutting down” of a muscle usually due to pain or inflammation

**Posterior**: towards the back of the body

**PROM**: “passive range of motion” = patient does nothing, movement performed by someone else

**Prone**: lying on your stomach

**ROM**: range of motion

**RPM**: revolutions per minute

**Supine**: lying on your back
Causes of Hip and Groin Pain

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<td></td>
<td>- Superficial groin, lateral hip, or posterior hip pain</td>
<td>- Tenderness to palpation</td>
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<tr>
<td></td>
<td>- Lateral or anterior snapping hip</td>
<td>- Pain with stretching and/or resistance to involved structures</td>
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<td>- Clicking, giving way</td>
<td>- Groin pain and/or clicking with the scour test</td>
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<td>- Groin pain with the SLR test</td>
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<th>FAI</th>
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<td>- Anterior pain with sitting</td>
<td>- Anterior pinching pain with the impingement test</td>
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<td>- Medial thigh pain</td>
<td>- Painful and/or limited IR</td>
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<td></td>
<td>- Morning stiffness</td>
<td>- Limited flexion ROM</td>
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<tr>
<th>Capsular laxity</th>
<th>Common Symptoms</th>
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<tr>
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<td>- Instability</td>
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<td>- Increased ER ROM with the leg roll test</td>
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<tr>
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<td></td>
<td>- Increased motion and/or apprehension with long-axis femoral distraction</td>
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*Note: The cause of hip is best determined by the LOCATION of pain.

- **Anterior Hip Pain** (ie. pain in the front of hip/groin): due to intra-articular (FAI, osteoarthritis, labral tear) vs. extra-articular (iliopsoas tendinitis, groin strain, hernia) pathology.
- **Posterior Hip/Buttock Pain**: most often referred from the spine or SI joints, and not the hip itself.
- **Lateral Hip Pain**: most often due to trochanteric bursitis or abductor (gluteus medius) tears.
Surgery Descriptions

Labral repair: The labrum is reattached to the acetabulum with suture anchors to hold it in place.

Debridement: Removal of small frayed edges of the torn labrum by an arthroscopic shaver tool.

Osteoplasty: An osteoplasty is performed at the head-neck junction of the femur. During this procedure a motorized burr is used to shave down the bony abnormality and re-creates a “normal” shape of the femoral neck.

Rim Trimming: A rim trimming procedure is used to address the bony abnormality of the acetabulum (socket) of the hip using a motorized burr.

Microfracture: A microfracture technique is performed to address cartilage lesions on the acetabulum or on the femoral head. A pic (awl) is used to create bleeding of the bony surface where the cartilage is damaged. This blood forms a clot which matures into new cartilage. The clot is delicate and requires minimal weight-bearing and good mobility for proper healing.

Chondroplasty: Minimal cartilage damage is repaired using a motorized burr tool to shave off any frayed edges.

Capsular Plication: A plication is done to tighten a loose capsule. During a capsular plication the capsular tissue is pulled together and closed with sutures to hold the tissues together and adding stability to the joint.

Thermal Capsulorraphy: During a thermal capsulorraphy, a high temperature probe is moved across the tissue in a striped pattern causing shrinkage of the tissue, thus stabilizing the joint.

Ligamentum teres debridement: In patients with partial tearing of the ligamentum teres, frayed tissue is removed similar to the labral debridement.

Synovectomy: A synovectomy is performed in patients who exhibit significant inflammation of the lining of the joint. During this procedure a heat probe is used to remove the irritated tissue.

Iliotibial Band Release: The Iliotibial band (ITB) is a thick band of tissue that runs from the hip to the knee along the outer side of the thigh. A release is done when the ITB is excessively tight, causing irritation (bursitis) to the outer aspect of the hip.

Labral Reconstruction: This procedure is performed when the labrum is small, of poor quality, or not repairable. A piece of fascia lata allograft or autograft is used to replace the damaged labrum. It is held in place with suture anchors along the acetabular rim.
PRE-OPERATIVE INSTRUCTIONS
DR. SANJEEV BHATIA

Please follow these instructions carefully. If you have any questions, please contact a member of Dr. Bhatia’s team at 513-985-1277.

Thank you for choosing Dr. Bhatia and Cincinnati SportsMedicine & Orthopaedic Center—Mercy Health for your care. We look forward to helping you and assisting with your recovery from surgery. Our surgery schedule times are determined the day before surgery. Our scheduler will contact you in the afternoon or early evening before your scheduled surgery to give you check in time information.

PRE-OPERATIVE HEALTH CLEARANCE
Pre-admissions testing is often required prior to surgery. You may need to get bloodwork (CBC, coags, electrolytes), a urine sample (UA), an EKG (if over age 40 or a history of heart problems), and a history and physical from your primary care physician as part of your preoperative clearance. If requested, this must be done within 3 weeks of your surgery date. Dr. Bhatia’s office will need the results prior to surgery. Please ask your physician to contact Dr. Bhatia’s office at 513-985-1277 if there are any questions.

PRIOR TO SURGERY
Please discontinue medications such as anti-inflammatories, ibuprofen, and Aleve one week prior to surgery. Discontinue all blood-thinners (Aspirin, Plavix, Coumadin, etc) one week prior to surgery. Discontinue all over-the-counter herbal medications or dietary supplements two weeks prior to surgery. You may continue taking Celebrex, Tylenol, tramadol (Ultram), and pain killers (ie. Vicodin/Norco) up until the day before surgery. We have a list of medications to discontinue prior to surgery if there are any questions.

Please drink plenty of water the day prior to surgery. Alcohol is not recommended the day before surgery. If you have a cold, fever, or upper respiratory infection before your surgery, please call the office and inform Dr. Bhatia’s team.

Please do not eat or drink anything after midnight prior to surgery. Eating prior to surgery will cause complications with anesthesia and may result in your surgery being cancelled.

MORNING OF SURGERY
You may take your regular medications such as high blood pressure medicines, thyroid medicines, seizure medications, and any cardiovascular medications the morning of surgery with a small sip of water.
Please check into the Operating Room the morning of surgery with a list of your regular medications including doses. You will meet with anesthesiology prior to surgery.

WHAT TO BRING TO SURGERY

• Athletic Shoes
• Extra Shorts
• Pants with snaps on the side, yoga pants, or sweat pants
• Regular home medications
• An extra duffle bag to be used after surgery for equipment

AFTER SURGERY
Often we recommend a Game Ready ice machine to help control swelling, help with pain control, and speed healing. The Game Ready is not usually covered by insurance but we feel is helpful in healing following your procedure.

Please schedule your post-operative appointments as soon as possible – Dr. Bhatia’s schedule will book up rapidly.

Please schedule your post-operative appointments at approximately 2 weeks, 6 weeks, and 12 weeks after surgery. Please call Aletha Kiner (513-985-1277) or the front desk (513-347-9999 or 513-232-BONE) to schedule your post-operative appointments.

PLEASE NOTE:
Certain procedures that Dr. Bhatia performs are considered unlisted because CPT has not yet assigned a procedure code for the procedure. All of his procedures are medically approved. However, CPT has not yet established a code for some of the procedures using arthroscopy of the hip. Some insurance companies will not recognize these codes, and appeals will need to be made.

If an unlisted code will be used for your surgery, our insurance department will contact you to discuss your insurance benefits.
Dr. Bhatia Hip Arthroscopy Post-Operative Instructions

Prescription Medications

**Indocin/Indomethacin:**
- This medication helps to prevent excessive bone growth after surgery, which can occur with any surgery involving the hip joint.
- Take 75 mg tablet take once per day for 10 days in the evening, with food. This medication can cause stomach upset, so be sure to take it with food.
- If you are unable to tolerate this medication, please let the office know so we can put you on an alternative medication. Do NOT take ibuprofen, motrin, advil, aleve, or naproxen while taking this medication.
- Once you have completed the 10 day course of this medication, you can take ibuprofen or aleve as needed.

**Aspirin:**
- This medication is given to help prevent blood clots after surgery. This may also cause stomach upset so try to take this with food as well.
- Please take 325mg daily.
- You will take this medication for a total of 30 days after surgery.

**Norco or Percocet:**
- This medication is for pain.
- This medication is to be taken AS NEEDED.
- Plan to stay on a scheduled dose of 1-2 tablets every 4-6 hours for the first 2-3 days after surgery.
- After 2-3 days you should be able to space out or discontinue the medication.
- Do not drive, drink alcohol, or take Tylenol/Acetaminophen while taking this medication.

**Colace:**
- Take 1-2 pills throughout the day to prevent constipation, which is common after surgery and while you are taking narcotics for pain control.
- It is normal to take several days to have a bowel movement after surgery.
- Drink plenty of clear liquids as the anesthesia can cause dehydration and constipation.

**Flexeril:**
- Take this medication to help prevent muscle spasm postoperatively.
- Take 1 tab (10 mg) every 8 hours as needed for muscle spasm; do not take more than 30 mg (3 tablets) in one day.

**Protonix (Pantoprazole):**
- Take this medication to help with stomach upset postoperatively.
- Take 1 tab (40 mg) daily.
Wound Care and Showering

• Leave the big surgical bandage on and do not shower for 48 HOURS.
• After 48 hours, remove bandages and gauze, but LEAVE STERI STRIPS (white tape, similar to white band-aids) in place during showers.
• It is normal to see bloody soaked fluid on the bandages.
• Apply waterproof band-aids to each incision prior to showering. If the wounds get wet while showering, this is OK; however, we prefer to keep the wounds dry during the first 5 days after surgery.
• In between showers, leave open to air.
• Do not apply lotions or ointments to the incisions.
• Your stitches will absorb over time and are buried under your skin.
• Do not soak in any pool/bath water until 4 weeks after surgery.
• Do not allow pets to sit on your lap or sleep in your bed for at least 6 weeks following surgery. Pets may harbor fleas or mites or other organisms that may cause a wound infection.

Physical Therapy

• Physical therapy should start ideally on the first day after surgery.
• If your surgery is on Friday it is okay to wait until early the following week.
• Choose a PT clinic close to your home so that you are compliant with your program, and schedule your first appointment for the day following surgery (be sure to call and schedule the surgery PRIOR to your surgery). For at least the first few weeks, it is recommended to go to a physical therapist who has experience with post-operative hip arthroscopy patients.
• For your first visit, please bring your prescription for physical therapy, as well as any protocols provided to you at your preoperative clinic visit. Your therapist should hopefully also have a copy of the protocols and have familiarity with the program. Protocols are also available online at www.cincinnatisportsmed.com ➔ Dr. Bhatia ➔ FAI Hip Arthroscopy PT protocol or through the Hip Preservation section of the website.
• At your first physical therapy visit, your PT should instruct you on proper weight bearing and teach your family member how to perform passive, light circumduction of the hip.

Weight Bearing

• You will be flat foot weightbearing (20 pounds) for a total of ___ weeks. Use crutches throughout this time period while walking.
• If you received SPINAL anesthesia, do not attempt to bear weight or walk until the anesthesia has completely worn off. The nurses in the postoperative recovery unit will help you determine when it is safe to get out of bed.
• After the feeling has returned to your leg, you may put 20 lbs of weight on that side.
• Please walk with your foot flat and mimic normal gait.
bearing slowly as directed by your therapist, unless you undergo a microfracture procedure as well (this will delay the time until you may begin full weight bearing, usually maintaining TTWB for a total of 7 weeks following surgery).

• Getting off the crutches takes each patient a different amount of time.
• Don’t try to rush yourself to get off the crutches.

Brace

• You will be provided with a hip brace to be worn for the first couple weeks following surgery, or until you are off crutches (usually 3-4 weeks). Always use crutches while wearing the brace and walk with flat foot weightbearing (20 pounds).
• If you had a microfracture procedure performed, you will wear the brace for 21 days following surgery (instead of 17).
• Brace Settings:
  • 0 degrees extension – 70 degrees flexion
  • Neutral rotation
  • 10 degrees abduction
• The brace is worn only when ambulating (walking), and is worn on the outside of your clothing.
• The purpose of the brace is to prevent hyperflexion and abduction (bringing the leg too close to the chest or bringing the leg too far away from the body).
• You will be fitted for your brace either before your surgical day or on your surgical day.
• The first few days, concentrate on icing the hip and wear the brace when you are up and about.
• You do NOT need to wear the brace while you are sleeping, on the CPM machine, laying on your stomach, using the upright bike, or icing your hip.
• You can remove the brace for showering and using the bathroom.
• The lateral post on the brace should be positioned over the lateral aspect of the leg.

Ice

• If using the ice machine, it will cycles on and off on its own.
  o Use it as much as you can for the first 72 hours.
  o Try to use it 4-5 times per day after the first 72 hours for the first two weeks after surgery.
  o You do not need it after 2 weeks.
  o You will receive information about picking up the ice machine at your preoperative visit.
  o Do not wear the brace over the ice machine pad.
• If using simple ice packs, ice the hip as much as you can for the first 72 hours – 20 minutes on, 20 minutes off.
  o Use 4-5 times per day after the first 72 hours.
  o Place the ice over the brace onto the hip, but never directly onto the skin.
  o Use as needed for the first 2 weeks.
Continuous Passive Motion (CPM) Machine

- The use of CPM has been shown to promote early healing following surgery and decrease the risk of scar tissue or adhesions post-operatively.
- Start on the day of surgery if you have time and feel up to it, otherwise the day after.
- Use this for a total of between 4 and 6 hours per day for a total of 2 weeks.
- You can split up into increments if you get sore/tired. You will need assistance to get into the CPM for the first couple of days after surgery.
- **Settings:** Start with the settings at 20 degrees extension and 55 degrees of flexion
  - Increase by 7-8 degrees per day as tolerated
  - Example: Day 1, 20 of ext and 55 of flexion. Day 2: 12 degrees of extension and 73 degrees of flexion, etc.
  - Do not go past 0 – 90 degrees.
- Use for a total of 2 weeks.
- To help in the prevention of lower back pain try and maintain proper spine alignment while in the CPM, you may roll a towel or use a small pillow behind your lower back.

Biking

- Gentle, no resistance, upright, stationary biking can begin the day after surgery.
- Do NOT use a recumbent bike! NO Nustep!
- Use non-operative leg to push the operative leg around gently.
- 20 mins on upright bike = 1 hour on motion (CPM) machine.
- You do not have to go out and buy a bike; rather, just use the bike while at PT.

Ted Hose

- You will be given a pair of ted hose (stockings) to wear after surgery. These help in the prevention of blood clots postoperatively.
- Please wear these at all times for the first 2 weeks following your surgery.

General Activity Levels

- It is beneficial to change positions often after hip arthroscopy. Alternate sitting, reclining, and lying down approximately every 30 minutes. Feel free to move around your home as much as you can tolerate, as you do not want the hip to get stiff following surgery.
- Spend 2-3 hours per day on your stomach (you can take the brace off for this).
- You will be permitted to drive (automatic transmission) **4 days** after surgery as long as you are not taking any narcotics and you feel comfortable doing so.

Follow-Up

- You will need to follow up in clinic with Dr. Bhatia 2 weeks following your surgery.
- Please call centralized scheduling at 513-347-9999 or 513-232-BONE to make an appointment.
- Routine post-operative follow up appointments will be made 2 weeks, 6 weeks, and 3
When should you contact the office

- You have a fever > 101.4 (a low grade temp is expected after surgery, but let us know if it gets this high!)
- You develop chills or sweats
- You have pus, pain or redness surrounding the incision sites
- You develop calf swelling, redness, pain or warmth after surgery
- You experience any chest pain or difficulty of breathing
- You can call the office at 513-985-1277 or call the Cincinnati SportsMedicine After Hours hotline at 513-891-3200

Possible Post-Operative Complications / Risks of Surgery

- **Infection:** The risk of infection is decreased with a sterile operating environment and antibiotics. For three days to your surgery, be sure to keep the skin of your hip as clean as possible using soap and water. Following surgery, careful handling of the incision sites reduces the risk of infection.
- **DVT:** (deep vein thrombosis, blood clot) is decreased through instituting early motion (CPM), mechanical means (TED hose) and medications (Aspirin). Following the pre-operative and post-operative instructions will reduce the risk of blood clot formation.
- **Pain:** With any surgical procedure, there is a potential complication of pain. Medication, ice, rest, compression, elevation and therapy reduce post-operative pain.
- **Numbness:** With hip arthroscopy, there is a small chance of numbness in the genitalia region briefly postoperatively. Also, you may experience some numbness of the upper outer portion of the thigh on the operative leg after surgery. This is due to stretching of the lateral femoral cutaneous nerve, a sensory nerve that is close to the surgical area. This nerve may be stretched or bruised during the procedure. This is normal and the numbness will resolve over time.
- **Heterotopic Ossification:** Any time we operate around the hip joint, there is a small chance of heterotopic ossification, which is abnormal bone growth in the surrounding muscles. We give you Indomethacin for the first 10 days after surgery to help prevent this complication. Please make sure to take the Indomethacin after surgery.
Dear Therapist,

Thank you for continuing the rehabilitation with Dr. Bhatia’s patient following their hip arthroscopic surgery. The intent of this program is to provide guidelines for progression of rehabilitation. It provides the basic exercises and techniques you will need to guide the patient to return to normal function. At the 6-8 week follow-up and if appropriate for the patient, Dr. Bhatia will determine whether the patient is ready to progress to an advanced functional training program for return to sport, a maintenance strength program, or to continue to work on “the basics” before progressing further.

- Utilize the rehab outline and exercise descriptions as a guide. This is a proven program in terms of exercises and treatment, but some patients may need to move slower.
- Utilize clinical decision making to adjust treatments if needed within given guidelines and precautions.
- Progression through each phase of rehabilitation is based on clinical criteria and patient progression, and the time frames are not strict. Please allow the patient and the hip to dictate the rehabilitation, not the timelines.
- Understand that the program should be tailored for the individual based on their ability to progress and respond to treatment. This concept should continually be emphasized to the patient. Advancing through the rehabilitation process involves an accurate assessment of joint function, strength, mobility and progressive overload based on the patient’s response.
- Primary goals at approx. 6 weeks out (non-mcfx) and 10 weeks out (McFx) are a normalized gait and good gluteal recruitment. We expect ROM restrictions at this time, especially External Rotation, Internal Rotation and Extension. Do not push through pain to achieve more, as these ranges will increase with a return to functional activity and not with overly aggressive stretching.

If you have any questions during the rehabilitation process, please feel free to contact Dr. Bhatia at Cincinnati SportsMedicine & Orthopaedic Center—Mercy Health at 513-985-1277.

Sincerely,

Sanjeev Bhatia, MD
Email: sbhatia@mercy.com
Hip Arthroscopy & Sports Medicine
Cincinnati SportsMedicine & Orthopaedic Center—Mercy Health
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III. Appendix II: Rehabilitation Progressions

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VI. Appendix V: Beighton’s Criteria
Post Operative Hip Arthroscopy Rehabilitation Protocol
Dr. Sanjeev Bhatia

Labral Repair with or without FAI Component

**General Post-Operative PT Guidelines**

- Patient to be seen 1-3x/wk for 12-16 wks.
- This protocol is written for the treating physical therapist and is not to substitute as a home exercise program for patients.
- The post-operative rehabilitation is just as important as the surgery itself.
- Please take a hands-on approach to the patient’s care utilizing manual therapy techniques to prevent and minimize post-operative scarring and tightness.
- Please emphasize form and control when instructing patients in exercise to prevent compensation and soft tissue irritation from compensatory patterns.
- This protocol serves as a guideline to patient care for the first 12-16 weeks of rehab.
- Return to full activities / sport is generally achieved between 5 and 6 months postoperatively, but may take up to one year for some patients.
- Patients may progress through the protocol at different rates, please always use clinical decision making to guide patient care and not strict timelines.
- DO NOT PUSH THOUGH PAIN.

**Initial Precautions**

**Weight Bearing**

- Non-microfracture procedures will remain Foot Flat Weight Bearing (20 pounds) for 3 weeks unless otherwise specified by Dr. Bhatia.
- Microfracture procedures will remain FFWB for 6-7 weeks.

**Initial ROM Restrictions for 2 weeks**

- Flexion 120° (Day 1-14)
- External Rotation 0° with Flexion at 0° (Day 1-14)
- Slight (<20 degrees) External Rotation ROM may be done gently at 90° of hip Flexion by a therapist only (Days 7-14)
- Extension to 0° (Day 1-14)
- Abduction to 45° (2 weeks total)
- May progress to ROM as tolerated after 14 days

**Other Comments / Restrictions**

- Avoid hip flexor irritation; No hip flexor strengthening until indicated in the protocol (ie. Phase II)
• CPM: at least 4-6 hours daily for first 3 weeks.
  • Microfracture procedures will require use of CPM for 6-8 weeks for 6-8 hours per day.
• Hip brace for 3 weeks, settings 0-90° flexion at neutral rotation and abduction/adduction
• Avoid impinging with flexion and FADIR ROM exercises

Phase 1 – Protection Phase (post-op weeks 1-4)
With Microfracture – post-op weeks 1-9

Goals:
• Provide patient with education on initial joint protection to avoid joint and surrounding soft tissue irritation
• Reduce swelling and pain
• Begin initial passive range of motion within post operative restrictions
• Initiate muscle activation and isometrics to prevent atrophy
• Progress range of motion promoting active range of motion and stretching
• Emphasize proximal neuromuscular control of hip and pelvis
• Initiate return to weight bearing and crutch weaning
• Normalize gait pattern and gradually increase weight bearing times for function

Precautions:
• Avoid treadmill walking (this will not start until week 12)
• Avoid irritation of the hip flexors, TFL, gluteus medius, ITB, and trochanteric bursa
• Avoid anterior capsular pain and pinching with range of motion
• Prevent low back pain and SIJ irritation from compensatory patterns
• Manage scarring around portal sites and at the anterior and lateral hip
• Do not push through pain with strengthening or range of motion

Pain and Swelling:
• PRICE – Protection, Rest, Ice, Compression, Elevation
  • Use these items together to reduce pain and swelling
  • At minimum, 5-6 times per day for 20-30 minute sessions
  • There is no maximum!
  • Icing is encouraged to be done in prone position to allow for mild stretching of the hip flexors
• Modalities as indicated - Ultrasound and Electric Stimulation
• Ankle Pumps – for swelling and DVT prevention

Range of Motion:
• Passive Range of Motion (week 1-6)
  • Partner-assisted ROM recommended 2-4 times per day, 20 minutes each episode
  • PROM Exercises
    • See Appendix I for Definitions of Exercises listed below:
• **Circumduction**, Neutral Circumduction, Supine hip flexion / abduction / ER / IR, Side-lying flexion, Prone IR / ER / extension, press-ups, Supine abduction, Quadruped rocking, Half kneeling pelvic tilts
• **Maintain ROM restrictions** for time periods as stated above

- **Manual Therapy Treatment Progressions (Weeks 1-6)**
  - Scar massage x 5 minutes
  - Incision portals – begin post op day 2 – week 3
- **Soft tissue mobilization x 20 – 30 minutes**
  - Begin POD 4 – wk 10-12
  - Begin with superficial techniques to target superficial fascia initially
  - Progress depth of soft tissue mobilization using techniques such as deep tissue massage, effleurage, pettrissage, strumming, perpendicular deformation, and release techniques
  - The use of mobilization with active and passive movement is very effective with this patient population (ART, functional mobilization etc.)
- **Soft tissue muscle groups and bony prominences**
  - **Anterior**: Hip flexors (Psoas, Iliacus, and Iliopsoas tendon), TFL, Rectus femoris, sartorius
  - **Lateral**: ITB, Gluteus medius (all fibers, especially anterior), Iliac crest and ASIS
  - **Medial**: Adductor group, Medial hamstrings, Pelvic floor
  - **Posterior**: Piriformis, Gluteus medius/minimus/maximus, Deep hip ER’s (gemellus, quadratus femoris, and obturator internus), Proximal hamstrings,Sacral sulcus/PSIS/SIJ, Erector spinae, Quadratus lumborum
- **Joint Mobilizations (3-12 weeks)**
  - Begin with gentle oscillations for pain grade 1-2
  - Caudal glide during flexion may begin week 3 and assist with minimizing pinching during range of motion
  - Begin posterior glides/inferior glides at week 4 to decrease posterior capsule tightness (may use belt mobilizations in supine and side lying)
  - Do not stress anterior capsule for 6 weeks post op with joint mobilizations
- **Active/Active Assist Range of Motion**
  - Stationary Bike without resistance 20 minutes per day (No recumbent biking to avoid hip flexor contractures)
  - Add resistance in week 3
  - AAROM beginning at week 2
  - AROM beginning at week 2-3 as tolerated
- **Hydrotherapy**
  - Aqua-jogging and ROM exercises are permitted when incisions have healed or stitches have been removed (~2weeks)

**Gait:**

- Crutches will be indicated for the first 3 weeks to keep excessive load off of the hip and protect healing structures. This will help to reduce swelling and pain.
Microfracture procedures must remain FFWB with crutches for 6-8 weeks.

- Weaning from crutches
  - Begin with weight shifting exercises
  - Load limited weight on 2 crutches
  - Single crutch walking
    - This will reduce weight on surgical leg by 25%
    - Be sure to place the crutch under the opposite arm
  - Walk small distances in home without crutches and take crutches for longer distances
  - **Please do not come off crutches until the patient can walk without a limp!**

- Gait Exercises to promote normalized hip extension and lumbar stabilization
- Hydrotherapy – water walking
  - Walk in water at shoulder level
  - Advance to walking at waist level

**Strength:**
- See Appendix II for Progressions
- Transverse Abdominus/Core isometrics in combination with all other isometric exercises
- Isometrics
  - Quad Sets (avoid SLR’s for 4-6 weeks to avoid hip flexor irritation)
  - Gluteal sets
  - Hamstring Sets
  - Ab/Adduction isometrics
  - External and Internal Rotation isometrics
- Open Chain Exercises (week 3)
  - Prone hip extension exercises
  - Glute Medius Exercises (sidelying or standing)
  - Quad and Hamstring dynamic strengthening in open chain

**Proprioception and Neuromuscular Re-education:**
- Begin open chain proprioception exercises
  - Prone IR/ER rhythmic stabilization exercise
- Light closed chain stability balance exercises (if pain free and weight bearing status permits)

**Criteria for advancement to Phase 2**
- Flexion to 120°
- Extension symmetrical to contralateral side
- 50% of FABER ROM as compared to contralateral side
- 75% of FADIR ROM as compared to contralateral side, without impinging
- No hip flexor contractures (otherwise remain in protective phase to decrease hip flexor tone and increase flexibility)
- Able to maintain full bridge position without compensations
- Mild deviations in gait with mild discomfort only
Phase 2 – Initial Strengthening (Post-operative weeks 5-10)
With Microfracture – Post-operative weeks 9-13

Goals:
• Eliminate Swelling
• Full active and passive ROM
• Normalize Gait
• Increase leg strength to allow for:
  o Walking 1 mile
  o Stair ascending/descending
  o Double knee bends without compensations
  o Single knee bend to 70° without compensations
  o Resisted Side stepping without pain

Precautions:
• Continue to avoid soft tissue irritation and flare ups that delay progression
• Be aware of increasing activity and strengthening simultaneously to prevent compensation due to fatigue
• Promote normal movement patterns and prevent compensations with higher level strengthening
• Do not push through pain

Swelling:
• Continue PRICE’ing if residual swelling
• Modalities as indicated - Ultrasound and Electric Stimulation

Range of Motion:
• Motion Specific Stretching to eliminate ROM deficits
  • Thomas stretch
  • Low Load Duration Stretching for FABER and FADIR position (while avoiding impingement)
  • Single Knee to Chest stretches
  • ITB stretching
• Manual Therapy as indicated for any motion restrictions
  • Continue to utilize manual therapy including soft tissue and joint mobilizations to treat patient specific range of motion limitations and joint tightness.
  • Soft tissue mobilization should be continued to address continued to complaints of soft tissue stiffness at surgical sites especially for pinching in anterior hip
  • Address any lumbar or pelvic dysfunction utilizing manual therapy when indicated

Strength:
• Please see Appendix II for Progressions of exercises listed below:
• Closed Chain Strength progression (Glutes and Quads)
  • Leg press with light weight and high repetitions
  • Mini Squats, 1/3 knee bends
  • Double knee bends to 90°
  • Single Knee Bends – advance to 70° as tolerated
  • Light plyometrics on shuttle after week 10
• Abduction Exercises
  • Side Steps with thera-band
  • Lateral Agility Exercise with Sport cord - with and without diagonals
• Hamstring Specific Exercises
  • Carpet Drags
  • Hamstring Curls
  • Physio-ball bridging knee bends
• Cardio
  • Bike or spinning with resistance
  • Elliptical trainer (begin at week 6)
  • Swimming as tolerated (may begin aqua training at week 3)

**Proprioception, Balance and Neuromuscular Re-education:**
• Begin double leg stability exercises on balance board
• Single leg balance on stable/semi unstable (foam) surface
• Single leg balance on balance board
• Variations of balance exercises with perturbation training
• Variations of balance exercises during alternate activity (i.e. ball tossing)

**Criteria for advancement to Phase 3**
• No residual swelling present
• Full Active and Passive ROM
• Ascending and Descending stairs with involved leg without pain or compensation
• Gait without deviations or pain after 1 mile of walking on level surface
• At least 1 minute of double knee bends without compensations
• Single knee bends to 70° flexion without compensations

**Phase 3 – Advanced Strengthening (Post-operative weeks 10-sport test completion)**

*Persons who do not participate in higher-level activities may not need to advance to phase 3. Activities that require advanced strengthening include: running, bounding sports, cutting sports and jumping sports, such as, skiing and snowboarding, golf, basketball, tennis and racquetball, soccer, football and hockey.*

**Goals:**
• Restore multi-directional strength
• Restore ability to absorb impact on leg (plyometric strength)
• Pass sport test

Strength, Agility, Balance and Stability Training:

1. Increase time on double knee bends with resistance
2. Increase time on single knee bends. Add resistance as tolerated
3. Forward backward jog exercises with sport cord
4. Lateral Agility exercise with diagonals
5. Jump-land training
6. Advanced perturbation, balance and stability exercises
7. Continue with cardio training

Criterion for advancement to Phase 4

• Pass sport test

Phase 4 – Return to Sport (passing of sport test – 6 months)

Goals:

• Safely and successfully return to sport

Strength and Agility

Agility Drills

* Chop-Downs
* Back Pedals
* W-Cuts
* Z-Cuts
* Cariocas
* Cutting Drills
* Sport Specific Drills

Adjust Strength and Cardio Regimen to demands of sport

Team Training Progression:

* Begin training with team at 50% participation level
* Advance to 100% participation
* Athlete may begin competition at the discretion of surgeon and/or physical therapist

Begin the following sports at the discretion of surgeon and/or physical therapist

* Running, Basketball, Volleyball
* Mountain biking
* Golf
* Soccer, football, tennis
* Skiing and snowboarding
Return to Play

• Before return to play is contemplated, patient must have appropriate ROM, strength, flexibility and endurance
• Must pass Functional Sports test

Cardiovascular Program (Weeks 1-12)

• Stationary Bike (no resistance) x 20 minutes, 1-2/day x first 4 wks
  • Increase duration on bike by 5 minutes/wk beginning at wk 2.
• Aquatic PT Program
  • Begin aquatic PT program week 3 (incisions must be well healed)
• Elliptical trainer – Begin wk 6 p.o.- Start with 10 minutes and increase 5 minutes/wk for next 6 wks
• Combination program- begin alternating stationary bike and elliptical at wk. 8 for 20 minutes total time progressing as tolerated.
• Treadmill walking program may begin at week 12

Functional hip sports test

<table>
<thead>
<tr>
<th>Functional hip sport test</th>
<th>Goal</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single knee bends</td>
<td>3 min</td>
<td>1 point for each 30 s completed</td>
</tr>
<tr>
<td>Lateral agility</td>
<td>100s</td>
<td>1 point earned for each 20 s completed</td>
</tr>
<tr>
<td>Diagonal agility</td>
<td>100s</td>
<td>1 point earned for each 20 s completed</td>
</tr>
<tr>
<td>Forward lunge on box</td>
<td>2 min</td>
<td>1 point earned for each 30 s completed</td>
</tr>
</tbody>
</table>


• See Appendix IV for instructions of all 4 exercises
• Single Knee Bend
  o Performed for 3 minutes at a pace of 1 second down and 1 second up without pelvic obliquity or knee valgus
  o One point for every 30 seconds successfully performed
  o Total of 6 points
• Lateral side-to-side
  o Performed with resistance cord attached to waist on involved side
- Push off involved side against the resistance of the cord and return onto involved leg with good absorption
  - 30° of knee flexion progressing to 70° in a controlled manner
- One point for every 20 seconds without compensation for 100 total seconds
- Total of 5 points if performed correctly without pain

- **Diagonal agility**
  - Similar to Lateral test but performed at 45° angle forward and backward from frontal plane
  - One point for every 20 seconds without compensation for 100 total seconds
  - Total of 5 points if performed correctly without pain

- **Forward box lunge** (onto a box set at height of the patient’s knee)
  - It is performed for 2 minutes with cord resistance
  - 1 point for every 30 seconds performed without pain or compensation
  - Potential of 4 points

**Scoring:**
- >17 is passing
- High-level athletes are expected to score 20/20
Appendix I

Passive ROM Definitions

Circumduction: Flex hip to 70 degree and knee to 90 degrees. Slowly move thigh in small circular motion clockwise. Repeat in counter clockwise direction. Avoid rotating hip into ER and IR during the motion. Perform this motion for 5 minutes in each direction.

Neutral circumduction- with knee extended slowly abduct the hip to 20 degrees. Move the leg in small circles clockwise then repeat counter clockwise. Perform 30 reps in each direction.

Supine hip flexion – slowly flex the hip with the knee bent, avoiding any pinch in the anterior hip. You may provide a caudal glide to avoid pinch at 3 wks post op. Perform 30 reps of this motion.

Supine abduction- Abduct the hip maintaining the hip in neutral rotation and perform 30 reps of this motion.

Supine ER – Bring hip to 70 degrees of flexion with the knee flexed to 90 degrees. Slowly rotate the foot inward towards the other leg. Perform 30 reps of this motion.

Supine IR- Bring the hip to 70 degrees of flexion with the knee flexed to 90 degrees. Slowly rotate the foot outward. Avoid any pinch in the groin or back of hip. Perform 30 reps of this motion

Side lying Flexion- Have patient lie on uninvolved side. Support the leg by holding it above and below the knee. Slowly flex the knee towards the chest maintaining the hip in neutral rotation. Perform 30 reps of this motion.

Prone IR- In prone position, flex patients knee to 90 degrees and slowly move the foot to the outside. Perform 30 reps of this motion.

Prone ER- In prone position, flex patients knee to 90 degrees and slowly move the foot to the inside towards back of other knee. Avoid anterior hip pain. Perform 30 reps of this motion.

Prone extension- In prone, flex the patients knee to 90 degrees. Grasp the anterior aspect of the patient’s knee. Stabilize pelvis with opposite hand and slowly extend the hip. Perform 30 reps of this motion.

Prone on elbows or press ups- Have the patient lie prone and slowly extend the lumbar spine by propping on their elbows. The patient may progress to prone press-ups as tolerated to stretch the hip flexors. Perform 2 sets of 10 repetitions.

Quadruped rocking- The patient assumes a hands and knees position. Keeping pelvis level and back flat, slowly rock forward and backwards from hands back to knees. Once the range of motions restrictions are lifted, the patient may begin to rock backward bringing buttock to heels stretching the posterior hip capsule. Perform 2 sets of 30 repetitions.

Half kneeling pelvic tilts- The patients assumes a half kneeling position bearing weight through the involved leg. The patient slowly performs a posterior pelvic tilt gently stretching the front of the hip. Perform 2 sets of 20 repetitions.
Appendix II

Initial Isometrics

Gluteal sets- Have the patient lie on back or stomach and gently squeeze buttocks. Hold for 5-10 seconds and repeat sequentially up to 30 times.

Quad sets- Have the patient lie on back or stomach and gently tighten the muscle on the front of your thighs. Hold for 5-10 seconds and repeat sequentially up to 30 times.

TA isometrics with diaphragmatic breathing- Have the patient lie on back and place fingers 2 inches inside of pelvic bones on lower abdomen at waist band. Instruct the patient to gently draw in until you feel tension under your fingers. You also may perform a kegal exercise prior to contraction. If you feel a bulge of stomach muscles and your fingers being pressed away you are squeezing to hard. Do not hold breath during contraction. Hold contraction for 5 slow breaths, relax, and repeat sequentially up to 10 times or at the therapist’s discretion.

Supine Progressions

Supine hook lying hip internal and external rotation

- **Internal rotation**- Have the patient assume hook-lying position with feet shoulder width apart slowly bring knees together and return back to neutral. Maintain a level pelvis throughout the motions. Repeat 30 times.
- **External rotation** – Assume hook-lying position and slowly rotate knees outward within the mid range of motion. Maintain a level pelvis throughout the motions. Repeat 30 times.

Pelvic clocks (12-6, 9-3, and diagonals)- Have patient assume a supine position with a bolster under the knees. The patient is instructed that they are lying on a clock face with 12 o clock being caudal and 6 being cephalad. Slowly move pelvis, so that the sacrum touches each number of the clock and returns to neutral. Perform clockwise and counterclockwise movements. Perform 10 repetitions each direction. Repeat 2-3 times/day.

Supine lower trunk rotations- Have patient assume a hook-lying position. Instruct the patient to slowly rotate their legs side to side. Initiate motion at hip joint and continue until pelvis and lumbar spine are off the bed. Rotate 30 times to each side. Repeat 2-3 times/day.

TA isometric with bent knee falls outs- Have patient lie supine with one knee flexed to 90 degrees and hip at 45 degrees and the other leg extended. Slowly rotate knee out to the side, maintaining a level pelvis and TA engaged. Perform 15 reps and repeat 2 sets both sides.

TA isometrics with marching- Have patient lie in hook-lying position. Perform a TA isometric maintaining a level pelvis. Slowly raise one foot off the support surface not moving the pelvis and isolating movement at the hip joint only. Repeat with the other leg on a marching type motion. Repeat 10-15 times with each leg and perform 2 sets. Avoid flexor irritation in early postoperative period (weeks 1-6).

Supine FABER slides with TA isometric- Do not start until at least POD 14. Have the patient place the heel of the involved leg at the medial malleolus of the opposite ankle. Slowly slide the heel and foot up the leg to the knee. Slowly stretch the knee toward the table at the top into the FABER position. Maintain a level pelvis
during the motion. Perform 10-15 reps and repeat 2 times.

**Bridging Series**

- **Double leg bridging**: Have the patient assume a hook-lying position. Instruct the patient to slowly raise their pelvis off the support surface. Imagine moving one vertebrae off at a time from the sacrum to thoracic spine. Maintain a level pelvis during the entire movement. Perform 10-15 repetitions and repeat 2-3 times.

**Progressions: Repeat all of the above instructions with...**

- **Bridge with adduction isometric**: Place a ball or pillow between the patients knees. Have the patient slowly squeeze the knees together while they slowly raise their pelvis off the support surface. Perform 10-15 repetitions and repeat 2-3 times.
- **Bridge with abduction**: Place a thera band or pilates ring around the outside of patient's knees. Instruct to begin by slowly press their knees into the band or ring. Perform 10-15 repetitions and repeat 2-3 times.
- **Bridge with single knee kicks**: Slowly straighten your uninvolved knee maintaining a level pelvis during the movement. Return to the double leg position and repeat with other leg. Perform 10-15 repetitions and repeat 2 times.
- **Single leg bridge**: Instruct the patient to cross their uninvolved knee over their involved knee in figure 4 position. Have the patient slowly raise their pelvis off the table keeping level at all times. Perform 10-15 repetitions and repeat 2 sets.

**Side lying Progressions**

**Side lying pelvic A/P elevation and depression**: Have the patient assume a sidelying position on uninvolved side. Flex the hips to 60 and knees to 90 degrees. Have the patient slowly bring the pelvis up and forward (elevation) keeping a neutral level spine posture. Have the patient then bring the pelvis down and back continuing to maintain a neutral spine. Avoid lumbar spine side bending and flexion and extension during the motion, isolate movement at the pelvis. Perform 10 reps and repeat 2 times.

**Side lying clams**: Have the patient assume a side lying position on the uninvolved side. Instruct the patient to depress the pelvis down and backward. Maintaining the pelvis in this position, slowly rotate the top knee away from the bottom knee keeping the feet together and maintaining a stable and neutral spine and pelvis. Perform 15 reps and repeat 2-3 sets; May add a thera band for resistance or pilates ring to perform isometric clams.

**Side lying reverse clams**: Have the patient assume a side lying position on the uninvolved side. Instruct the patient to depress the pelvis down and backward. Maintaining the pelvis in this position, slowly rotate the top foot away from the bottom foot keeping the knees together and maintaining a stable and neutral spine and pelvis. Perform 15 reps and repeat 2-3 sets.

**Side plank progression**

- **Half side plank taps**: Have patient assume a side lying position on involved side with knees flexed to 90 degrees and hip at 0 degrees extension in line with shoulders. The patient’s bottom elbow in placed at 90 degrees directly under the bottom shoulder. Slowly push both
knees into the table lifting the pelvis so its line with the shoulder, pause at the top for 3 seconds and return to the starting position. Repeat 15 times and do 2-3 sets.

- **Half side plank holds** – Same as above but the position is held from 30 seconds to 3 minutes. Repeat 1-3 times.
- **Modified side plank holds** - The patient assumes a half side plank position. The top knee is extended with the hip in neutral resting behind the bottom leg which is still flexed at 90 degrees. Slowly push the bottom knee into the table lifting the pelvis so its in line with the shoulder. The position is held for 30 seconds progressing to 3 minutes.
- **Full side planks** - The patient assumes a side lying position the hips and knee extended and the pelvis level and spine in neutral. The bottom elbow in flexed to 90 degrees and shoulder is abducted to 90. Press the outside of the bottom foot into the table and lift the pelvis maintaining a neutral spine throughout the exercise. Hold for 30 seconds to 3 minutes as tolerated. Repeat 1-3 times.

**Prone Progressions**

**Prone alternate knee flexion with TA isometric** – Have the patient assume the prone position. Instruct the patient to perform a TA isometric maintaining a level pelvis. Slowly flex one knee at a time keeping the pelvis level and minimizing any movement during the motion with the legs. Repeat 10-15 reps with each leg and perform 2 sets.

**Prone hip IR and ER** – Have the patient assume a prone position with a level pelvis. Slowly rotate the involved leg into IR and ER maintaining a level pelvis and keeping the range of motion in med range. Repeat 15 reps each direction and perform 2 sets.

**Prone hip extension with extended knee** - Have the patient assume the prone position. Instruct the patient to perform a TA isometric to maintain a level pelvis and stable lumbar spine. Slowly have the patient extend the hip with the knee in extension using the buttock and minimizing hamstring activation during the movement. The patient should just raise the leg off the table and not move the pelvis or arch the low back during the motion. Repeat 15 times with each leg and perform 2 sets.

**Prone hip extension w flexed knee** - Slowly have the patient extend the hip with the knee flexed to 90 degrees using the buttock. Repeat 15 times with each leg and perform 2 sets.

**Prone alternate arm and leg extensions** - Have the patient slowly extend the involved hip with the knee in extension and simultaneously raise the opposite arm off the surface, maintaining a neutral spine. Alternate movements with the other side. Repeat 15 times w each side and perform 2 sets.

**Prone hip extension on exercise ball** - Have the patient lie prone over a exercise ball so that the pelvis in supported and the spine is in neutral position. The hands are placed on the floor in push up position and the legs are extended so that the patient is on the toes. The patient is instructed to slowly lift on leg at time keeping the low back relaxed and the pelvis still. Perform 15-20 reps with each leg. Perform 2-3 sets.

**Prone alternate arm and leg extensions on exercise ball** - Have the patient lie prone over an exercise ball so that the pelvis in supported and the spine is in neutral position. The hands are placed on the floor in a push up position and the legs are extended so that the patient is on the toes. The patient is instructed to slowly lift one arm leg and the opposite leg simultaneously keeping the mid and low back relaxed and the pelvis still. Perform 15-20 reps with each arm. Perform 2-3 sets.
Prone plank progressions

- **Modified prone plank**- Have the patient assume a position where they are on the knees and elbows. The forearms and hands are parallel. The spine and pelvis are in a neutral position. Instruct the patient to flex knees to 90 degrees maintaining a neutral spine and pelvis as they come onto the knees and elbows. Hold this position for 30 seconds to 60 seconds as tolerated. Perform 3 sets.

- **Half prone plank/Pillar bridge**- Instruct the patient to assume a prone plank position on the elbows and toes. Maintain a neutral spine and pelvis at all times. Hold this position for 30 seconds to 2 minutes.

- **Full prone plank**- Instruct the patient to assume a full prone plank position with the arms in a push up position. Maintain a neutral spine and pelvis during the exercise. Hold this position for 60 seconds to 3 minutes.

- **Full or Half prone plank on BOSU**- Place the feet on either the soft or hard side of a BOSU. Maintain a neutral spine and pelvis during the exercise. Hold this position for 60 seconds to 3 minutes.

- **Full or Half prone plank with lateral slides**- Place toes on a slide board and slowly abduct legs out to side maintaining a level pelvis and spine during the movement. Hold this position for 60 seconds to 3 minutes.

Quadruped Progressions

- **Quadruped anterior/posterior pelvic tilts**- Have the patient assume a quadruped position with the hands positioned directly under the shoulder and knees under the hips. The spine and pelvis are in a neutral position. The patient is instructed to tilt the pelvis arching and rounding the low back during the movements. Perform 30 reps and perform 2 sets.

- **Quadruped arm lifts** – Have the patient assume a quadruped position with the hands positioned directly under the shoulder and knees under the hips. The spine and pelvis are in a neutral position. The patient is instructed to lift one arm at a time keeping the trunk and pelvis still and relaxed. Perform 15-20 reps with each arm. Perform 2-3 sets.

- **Quadruped hip extensions**- Have the patient assume a quadruped position with the hands positioned directly under the shoulder and knees under the hips. The spine and pelvis are in a neutral position. The patient is instructed to lift one leg at a time keeping the trunk and pelvis still and relaxed. Perform 15-20 reps with each arm. Perform 2-3 sets.

- **Quadruped alternate upper and lower extremity lifts**- The patient is instructed to lift one arm and the opposite leg at a time keeping the trunk and pelvis still and relaxed. Perform 15-20 reps with each arm. Perform 2-3 sets.
  - May add resistance with exercise band or perform movement with same sides to increase difficulty

½ Kneeling Progressions

- **½ kneeling pelvic clocks**- The patient assumes a half kneeling position on the involved knee. The patient spine is in neutral and pelvis level. The patient is then instructed to slowly moving pelvis from 12-6 o’clock positions. Once control is established and range of motion is gained begin to move in opposite direction between numbers 1-7, 2, 8, 3-9, 4-10, 5-11. Repeat 20 times each direction in
ranges that are tight. Perform 2-3 sets. Repeat on uninvolved.

½ kneeling weight shifts- The patient assumes a half kneeling position on the involved knee. The patient’s spine is in neutral and the pelvis level. The patient is instructed to shift the body forward onto the front leg while maintaining a neutral spine and not letting the back arch or round. A gentle stretch should be felt in the front of the hip. Hold position for 15 seconds and repeat 10-15 times on each leg.

½ kneeling upper shoulder girdle strengthening- The patient assumes a half kneeling position on the involved knee. The patient is instructed to perform upper extremity strengthening exercises focusing on the shoulder girdle and trunk using Resistance bands, dumbbells, medicine balls, etc. upper extremity strengthening exercises are performed. The patient is instructed to always maintain a neutral spine and pelvis during the exercise.

½ kneeling trunk rotations- The patient assumes a half kneeling position on the involved knee. The arms are extended out in front with the hands together. The patient rotates the trunk and upper extremities side to side while maintaining a neutral spine and pelvis. The pelvis remains forward and in neutral during the exercise and the trunk is rotated from the top down. Repeat 10-15 times to each side and perform 2-3 sets.

Gait Progression

Standing side to side weight shifts- Have the patient stand at the edge of table to chair and shift weight side to side, maintaining a level pelvis. Perform 2-3 sets for 30-90 seconds.

Standing anterior and posterior weight shifts- Have the patient in stagger stance position with the involved leg forward. The patient is instructed to shift the body weight to the front leg until the back toes lift off the floor. The pelvis and spine are maintained in a neutral position. Perform 2-3 sets for 30-90 seconds. Repeat with the uninvolved leg forward. Facilitation to the pelvis in diagonal directions is also beneficial for gait re-training.

Backward walking- Have the patient walk backward focusing on extension of involved hip and maintaining neutral spine and pelvis.

Side stepping- Have the patient side step with the knees slightly flexed and the spine and pelvis in neutral. Maintain a level pelvis and shoulders during the movement.

Side stepping with resistance band- Place a resistance band around the ankles. Have the patient assume a one third knee bend position, bending the knees to approximately 30 degrees of flexion and keeping the pelvis level. Have the patient slowly side step keeping the shoulder and pelvis level and avoiding any trunk motion. Do not let the feet come together, always maintain the feet shoulder width apart during the movements. The patient should perform the side stepping to both sides. Have the patient step 30 feet one direction and 30 feet the opposite direction. Repeat 2-3 laps.

Retro walking with resistance band- Place a resistance band around the ankles. Have the patient assume a one third knee bend position, bending the knees to approximately 30 degrees of flexion and keeping the pelvis level. Have the patient slowly step in a diagonal and backward direction. Bring the opposite foot to the step foot. Repeat to the other side. Have the patient step 30 feet one direction and 30 feet the opposite direction. Repeat 2-3 laps.
Closed Chain Squat Progression

Exercise ball wall sits- Have the patient stand with an exercise ball placed in the low back against a wall. Have the patient stand so that the feet are shoulder width apart and so that the knees do not go past the toes during a squat. Instruct the patient to slowly squat as if sitting in a chair. Have the patient maintain a neutral spine and slowly return to starting position. Have the patient perform 3 sets of 15-20 repetitions.

One third knee bends – Have the patient stand with the feet shoulder width apart and the feet slightly toed in. Instruct the patients to squat down as if they were going to sit in a chair only flexing the knees to 30 degrees. The spine is in neutral and pelvis level throughout the exercise. Repeat 20 times and perform 3 sets.

Double leg squats – Instruct the patient to slowly work on squat depth working towards to 70 degrees of flexion and the knees and hips maintaining a neutral spine.

Double leg squat with weight shifts- Instruct the patient to slowly shift weight side to side while maintaining a double leg squat. Perform 3 sets of 15-20 repetitions each side.

Balance squats- Have the patient place the uninvolved foot on a chair behind them using the foot only for balance. Have the patient begin with a one third knee bend on the involved and progressing to a squat position as tolerated. Instruct the patient to avoid pushing through the support leg. Perform 3 sets of 15-20 reps.

Single leg one third knee bends- Have the patient assume single leg stance on the involved leg while maintaining a level pelvis. Instruct the patient to slowly squat down to 30 degrees of knee flexion as if they were sitting in a chair. Avoid femoral valgus/IR on the squat leg and dropping the pelvis on the contralateral side. Perform 3 sets of 15-20 reps

Single leg squats- Have the patient squat to 70 degrees of knee and hip flexion. Perform 3 sets of 15-20 reps

Balance squats with rotations- Have the patient slowly rotate trunk side to side with arms held together out in front of patient. May hold a medicine ball to increase difficulty. Perform 3 sets of 15-20 reps

Slide Board Exercises

Lateral slides - Have the patient assume a one third knee bend position. Slowly slide the involved foot outward extending the knee. The standing knee is maintained in a neutral position at 30 degrees of flexion. The pelvis stays level and spine in neutral. Repeat 20-30 times and perform 2-3 sets. You can also have patient perform this moving the leg at a diagonal into extension as if skating.

Lateral lunge slides- Have the patient assume stand with knees extended and shoulder width apart with involved leg on slide board. Instruct the patient to slowly slide the involved foot outward squatting onto the uninvolved leg as if lunging. The standing knee is maintained in a neutral position during the movement. The pelvis stays level and spine in neutral. Repeat 20-30 times and perform 2-3 sets. You can also have patient perform this moving the leg at a diagonal into extension as if skating.
Hip split slides- Have the patient stand with both feet on the slide board with the outside foot resting against the edge of the board. Instruct the patient to slowly push off the outside foot sliding their body towards the opposite side but keeping their outside foot against the board. The pelvis should remain level at all times and the knees should be straight during the entire movement. Slowly bring the outside leg back to the starting position by pulling the leg in and returning to a standing position. Repeat this slide in both directions. Perform 15 repetitions and do 2-3 sets.

Reverse lunge slides- The patient assumes a staggered stance position, standing with the involved leg off the end of the slide board and the uninvolved foot on the board. The patient is instructed to slowly slide the uninvolved (back leg) backward bending the involved knee into a lunge position. Do not bring the knee past the toes and maintain a level pelvis and upright neutral spine during the movement. Slowly return to the starting position bring your involved knee to an extended position. Perform 15 repetitions and do 2-3 sets.

Lunge Progressions

Split lunge- Have the patient assume a staggered split stance position with the involved leg forward. Have the patient slowly lower the body toward the floor bending both knees so that the end position is lunge. Maintain a level pelvis and lumbar spine during the movement. Perform 3 sets of 15-20 reps

Forward lunge- Instruct the patient to slowly lunge forward onto involved leg. Maintain a neutral pelvis and trunk posture during the motion. Have the patient slowly absorb onto involved leg avoiding any compensation at the knee. Perform 3 sets of 15-20 reps. Repeat with the other leg.

Lateral lunge- Instruct the patient to slowly lunge to the involved side. Perform 3 sets of 15-20 reps

Reverse lunge- Instruct the patient to slowly perform a reverse lunge by stepping backward with the uninvolved leg. Perform 3 sets of 15-20 reps

Lunge with trunk rotations- Have the patient slowly rotate the trunk side to side with the arms out in front of them from any of the lunge positions. Perform 3 sets of 15-20 reps

Balance Progressions

Single leg balance- Have the patient shift weight to involved leg while maintaining a level pelvis and neutral spine. Have the patient hold the position for 30-60 seconds and repeat 3 times.
- May have the patient stand on altered surface to increase difficulty (Foam/BOSU/dynadisc)

Standing single leg hip hiking with ball- Have the patient stand on the involved leg with the opposite pelvis against an exercise ball that is resting on the wall (at hip height). Have the patient bend the uninvolved knee (ball side). Instruct the patient to slowly hike the pelvis upward on the uninvolved side by squeezing the buttock. Instruct the patient to not use their back to hike their pelvis but focus on contracting the muscles of the buttock. Repeat 20 times and perform 2-3 sets.

Standing single leg balance with opposite hip abduction isometric- Have the patient stand on the involved leg with the opposite knee against an exercise ball that is resting on the wall at knee height. Have the patient, slightly bend both knees to 20 degrees of flexion. Then instruct the patient to bend the uninvolved knee to 90 degrees and press the outside of the knee into the ball keeping the pelvis level. If
the patient's uninvolved side pelvis begins to drop, instruct the patient to slowly hike the pelvis upward on the uninvolved side by squeezing the buttock. Instruct the patient to not use their back to hike their pelvis but focus on contracting the muscles of the buttock. Maintain a static hold on this position for 5-10 seconds and repeat 10-15 times.

**Standing single leg balance with opposite hip isometric IR** - Have the patient lean into the wall with both arms out in front as in a wall push up position. The patient's body should be slightly angled toward the wall. Have the patient raise up onto the balls of both feet. Instruct the patient to flex the uninvolved hip and to 90 degrees of flexion. Manually resist internal rotation of the patient's uninvolved leg while they maintain a level pelvis. Keep the spine in neutral position throughout the movement. Fatigue should be felt in the involved gluteus medius. Perform 10-15 resisted IR's and do 2-3 sets.

**Standing gluteus medius isometric with FR in running position** - Have the patient stand on the both legs with the uninvolved knee against a foam roller that is resting on the wall just above the knee. Have the patient shift their weight onto the balls of both feet. Instruct the patient to slightly bend both knees to 20 degrees of flexion as if they are bringing the knees over the toes (or stretching out ski boots). Have the patient slightly lean the trunk forward maintaining neutral spine and keeping the pelvis level. Then instruct the patient to bend the uninvolved knee to 90 degrees and press the outside of the knee into the foam roller while keeping the pelvis level. If the patient's uninvolved side pelvis begins to drop, instruct the patient to slowly hike the pelvis upward on the uninvolved side by squeezing the buttock. Instruct the patient to not use their back to hike their pelvis but focus on contracting the muscles of the buttock. Maintain a static hold on this position for 5-10 seconds and repeat 10-15 times.
Appendix III
Exercises Week 0-2

Circumduction

Log Roll- Internal
TA Bracing

PROM – Heel Slides
Glute Sets

Quad Sets

Quad Rocking
Hip Adduction Isometric

Hip Abduction Isometric
Hip Isometrics- Adduction

Hip Isometrics – Abduction
Double leg bridge

Cat Camel
Bike

Week 2-4

Seated Hamstring Stretch
Piriformis Stretch

Stool Rotation Stretch- Neutral to ER

Stool Rotation Stretch- Neutral to IR
Assisted Hip Ab/Adduction Slide board

Standing Hip Abduction with IR
Bent Knee Fall-Out

Step Down
Lateral Step Up

Clams
Figure “4” Slide
Fish Tails

Hip Hiking
Balance Board

Standing Rotation Against Resistance
Single Leg Standing on Firm Surface

Ab Bracing with Marching
Weeks 4-8

Mobilization – Lateral with Rotation

Mobilization – Inferior with Rotation
Standing Quad Stretch

Hip Flexor Stretch
Tall Kneeling
Multi-Plane Stepping

Single Leg Standing on Foam Surface
Double Leg Press

Single Leg Press
Core- Front Plank Progression
Td Side Step
Quadruped Progression to Alternate Arm and Leg
½ Kneeling Rotation
Prone Extension (Flexion to Neutral)

Week 8-12

Prone Alt Arm and Leg Ext
Tall Kneeling Against Resistance
Forward Lunge

Body Weight Double Leg Squat
Single Leg Bridge
Monster Walks

Bridge with Abduction
Wall Squats with Ball

Standing Hip Abduction Maintaining Neutral Pelvis
Mini Squat to HR

Single Leg Squat Maintaining Level Pelvis
Core- Side Plank Progression

Core- Side Planks

Core- Side Plank Progression
Ball Progression - Arm and Leg Extension
Lateral Lunge
Appendix IV: Sports Test Instructions

**Single Knee Bend**

**Purpose:** To test single leg endurance strength and evaluate patellar tracking.

**Supplies:**
- Sport Cord (Topper Sports Medicine, black cord)
- Goniometer
- Stopwatch

**Description:** The Athlete will perform single knee bends with cord resistance to 60° at a cadence of 1 second up and 1 second down for a goal of 3 minutes. The movement is between 30°-60° of flexion with the knee never fully straightening past 30° throughout the 3 minutes. To cue the athlete the depth of 60° the buttocks can lightly touch the seat of a chair or object. Two fingers are allowed for balance on a chair back.

**Setup:**
1. With a goniometer, measure a 60° knee bend and place a chair in a position to allow the athlete's buttocks to lightly touch at that depth.
2. The athlete places the heel of the foot on the cord at a position so the D-ring of the handle is aligned with the knee joint line to remove slack from the cord.
3. Tension is set by pulling the cord handle to the waist line and holding. Having the athlete hook their thumb around their pant line is helpful in maintaining tension on the cord.
4. Two fingers of the opposite hand are allowed to lightly touch another chair back for balance

**Technique:** The athlete must perform each repetition of a single knee bend without the following:
- Trendelenburg sign (pelvis must remain level)
- the knee locking in full extension
- the knee “collapsing” into medial rotation / adduction
- the patella extending past the toe

Cuing should be provided when one of the following compensations are noted. **If unable to correct STOP TEST.**

**Scoring:** One point is earned for each 30-second increment completed with proper form for a total of 6 possible points.

**Testing is stopped if and when:**
- Form: once the subject is unable to complete single knee bends without compensation even with cuing.
- Pain: the patient has pain > 3/10 OR reproduces their pain
- Endurance: the athlete fatigues
Lateral Agility

**Purpose:** To test the ability of the leg to accept load (absorb) and push off in a lateral direction.

**Supplies:** Sport Cord (Topper Sports Medicine, black cord)  
Stopwatch and Tape

**Description:** The athlete will hop laterally with cord resistance from their surgical leg, land momentarily on their non-surgical leg, only to return onto their surgical leg with the cord pulling them back to the starting position for a total test time of 100 seconds. Each repetition of 1 second includes exploding laterally off the surgical side, landing momentarily on the opposite leg, and then returning to the starting position with emphasis on absorbing by bending at the hip and knee with 30 degrees of knee excursion. Excursion is defined as the amount of absorption from knee flexion at landing to max knee flexion.

**Setup:**  
1. Place the belt through the sport cord handles and then attach around the waist.  
2. Attach the other end of the sport cord to the door jam or secure post.  
3. Stand sideways with the involved leg toward the cord attachment.  
4. Step away laterally until tension is reached where the athlete slightly compensates with leaning and place a line with tape on the lateral aspect of the involved foot.  
5. Measure the distance from the greater trochanter to the floor.  
6. Use this measured distance to place a second tape line parallel to the first.

**Technique:** The athlete must perform each lateral hop by landing on or inside the first tape line with the involved foot and on or outside the second tape line with the uninvolved foot. Only one foot should be on the ground at the same time and the athlete must absorb onto the involved leg without the following:  
- Trendelenburg sign (pelvis must remain level)  
- the knee "collapsing" into medial rotation / adduction  
- the patella extending past the toe  
- losing control or stability

Cuing should be provided when one of the following compensations are noted. **If unable to correct STOP TEST.**

**Scoring:** One point is earned for each 20 second increment completed with proper form for a total of 5 possible points.

**Testing is stopped if and when:**
• Form: once the subject is unable to complete single knee bends without compensation even with cuing.
• Pain: the patient has pain > 3/10 OR reproduces their pain
• Endurance: the athlete fatigues

**Diagonal Lateral Agility**

**Purpose:** To test the ability of the leg to accept load (absorb) and push off in a diagonal direction.

**Supplies:** Sport Cord (Topper Sports Medicine, black cord) Stopwatch and Tape

**Description:** The athlete will hop diagonally forward at a 45° angle with cord resistance from their surgical leg, land momentarily on their non-surgical leg, only to return onto their surgical leg with the cord pulling them back to the starting position. The following repetition the athlete will hop diagonally backward at a 45° angle. The goal is 100 seconds total. Each repetition of 1 second includes exploding diagonally forward or backward at 45° angles off the surgical side, landing momentarily on the opposite leg, and then returning to the starting position with emphasis on absorbing by bending at the hip and knee with 30 degrees of knee excursion. Excursion is defined as the amount of absorption from knee flexion at landing to max knee flexion.

**Setup:**
1. Place the belt through the sport cord handles and then attach around the waist.
2. Attach the other end of the sport cord to the door jam or secure post.
3. Stand sideways with the involved leg toward the cord attachment.
4. Step away laterally until tension is reached where the athlete slightly compensates with leaning and place a line with tape on the lateral aspect of the involved foot.
5. Measure the distance from the greater trochanter to the floor.
6. Use this measured distance to place a second tape line at a 45° angle forward and a third tape line at a 45° backward to form a “V” if connecting the lines.

**Technique:** The athlete must perform each diagonal lateral hop by landing on or inside the first tape line with the involved foot and on or outside the second or third tape line with the uninvolved foot (Each foot should land parallel with each tape line). Only one foot should be on the ground at the same time and the athlete must absorb onto the involved leg without the following:
- Trendelenburg sign (pelvis must remain level)
- the knee “collapsing” into medial rotation / adduction
- the patella extending past the toe
- losing control or stability
Cuing should be provided when one of the following compensations are noted. If unable to correct STOP TEST.

**Scoring:** One point is earned for each 20-second increment completed with proper form for a total of 5 possible points.

**Testing is stopped if and when:**
- Form: once the subject is unable to complete single knee bends without compensation even with cuing.
- Pain: the patient has pain > 3/10 OR reproduces their pain
- Endurance: the athlete fatigues

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**Forward Box Lunges**

**Purpose:** To test the lower extremity strength and endurance into extension.

**Supplies:** Sport Cord (Topper Sports Medicine, black cord)
Stopwatch and Tape

**Description:** The athlete will perform alternating forward lunges onto a box with cord resistance at a cadence of 2 seconds per lunge for a goal of 2 minutes. The movement is a forward lunge with maximum hip extension without compensation at the pelvis or spine throughout the 2 minutes.

**Setup:**
1. Place the belt through the sport cord handles and then attach around the waist.
2. Attach the other end of the sport cord to the door jam or secure post.
3. Stand facing away from the cord attachment.
4. Step forward until tension is reached where the athlete slightly compensates by leaning and tape a line in front of the feet.
5. Measure the distance from the greater trochanter to the floor.
6. Place a stable box or chair the height of the athlete’s knees in front of them at a distance equal to the measure of the greater trochanter to the floor.

**Technique:** The athlete must perform alternating forward lunges onto the box keeping their planted leg behind the line and extending the hip without the following:
- Trendelenburg sign (pelvis must remain level)
- Excessive lumbar hyperextension
- Pelvic rotation

Correct performance of this activity is through proper extension of the hip.

**Scoring:** One point is earned for each 30-second increment completed with proper form for a total of 4 possible points.
Testing is stopped if and when:

• Form: once the subject is unable to complete single knee bends without compensation even with cuing.

• Pain: the patient has pain > 3/10 OR reproduces their pain

• Endurance: the athlete fatigues
Appendix V: Beighton’s Scale

<table>
<thead>
<tr>
<th>Joint</th>
<th>Finding</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>left little (fifth) finger</td>
<td>passive dorsiflexion beyond 90°</td>
<td>1</td>
</tr>
<tr>
<td>right little (fifth) finger</td>
<td>passive dorsiflexion &lt;= 90°</td>
<td>0</td>
</tr>
<tr>
<td>left thumb</td>
<td>passive dorsiflexion to the flexor aspect of the forearm</td>
<td>1</td>
</tr>
<tr>
<td>right thumb</td>
<td>passive dorsiflexion to the flexor aspect of the forearm</td>
<td>1</td>
</tr>
<tr>
<td>left elbow</td>
<td>hyperextends beyond 10°</td>
<td>1</td>
</tr>
<tr>
<td>right elbow</td>
<td>hyperextends beyond 10°</td>
<td>1</td>
</tr>
<tr>
<td>left knee</td>
<td>hyperextends beyond 10°</td>
<td>1</td>
</tr>
<tr>
<td>right knee</td>
<td>hyperextends beyond 10°</td>
<td>1</td>
</tr>
<tr>
<td>forward flexion of trunk with knees full extended</td>
<td>palms and hands can rest flat on the floor</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>palms and hands cannot rest flat on the floor</td>
<td>0</td>
</tr>
</tbody>
</table>

A Beighton score of 5/9 or greater is considered significant. ⁶
References
