# MFR for the Knee

Day 1

- Review the relevant anatomy for the knee including bones and landmarks, and all muscles directly attach to or cross over the knee
- Learn to assess basic types client knee misalignments
- Discuss various knee dysfunctions that clients commonly present with from structural issues to functional ones and how massage can help
- Practice bodyreading and assessment on each other

#### Why the Knee Matters in Full-Body Alignment (Part 1)

- Common contributor to hip pain, sacroiliac (SI) joint strain, and low back dysfunction.
- Poor tracking or chronic tightness can create compensation patterns up or down the kinetic chain.
- Alignment issues in the foot/ankle or hip/pelvis often transfer directly to the knee.
- The knee functions as a hinge joint situated between the complex joints of the hip and ankle.

#### Why the Knee Matters in Full-Body Alignment (Part 2)

- Unaddressed knee misalignment can accelerate degeneration in multiple joints.
- Proper knee motion supports efficient gait and shock absorption.
- Massage therapy can restore glide, balance muscle tension, and support realignment.

#### Prevalence and Trends in Knee Health

- Lifetime risk of developing symptomatic knee osteoarthritis is estimated at 45%.
- By 2030, total knee replacement surgeries are projected to grow 673% to 3.5 million per year.
- Nearly 800,000 total knee replacements are performed annually in the U.S.
- Approximately 25% of U.S. adults over age 45 experience frequent knee pain.







Soure: https://www.verywellhealth.com/arthritis-affects-daily-living-activities-189933 https://www.cdc.gov/ https://en.wikipedia.org/wiki/Knee\_pain

#### **KNEE REPLACEMENT SURGERY** FACTS & FIGURES



#### **Total Knee Replacement (TKR)**

	Age group	Female	Male
	<50	0.1%	0.1%
1	50-59	1.8%	1.2%
-	60-69	5.5%	3.6%
18	70-79	10.1%	7.3%
	80-89	11.0%	8.8%
	90+	7.4%	7.4%

4.7 million (3.0 million women, 1.7 million men) individuals with total knee replacement in 2010

#### Skeletal Anatomy of the Knee

- Bones: Femur, Tibia, Fibula, Patella
- Ligaments: Anterior Cruciate Ligament (ACL), Posterior Cruciate Ligament (PCL), Medial Collateral Ligament (MCL), Lateral Collateral Ligament (LCL)
- Cartilage: Articular cartilage covering joint surfaces
- Menisci: Medial and lateral meniscus
- Bony Landmarks: Tibial tuberosity, femoral condyles, patellar surface

#### Anatomy Review: Bones of the Knee

- Femur: Thigh bone; articulates with tibia and patella
- Tibia: Shin bone; bears most of the body's weight
- Patella: Kneecap; protects knee joint
- Fibula: Lateral to tibia; provides muscle attachments - does not connect to upper leg with ligaments



### Ligaments of the Knee

- ACL: Prevents anterior displacement of tibia
- PCL: Prevents posterior displacement of tibia
- MCL: Provides medial stability
- LCL: Provides lateral stability



#### **Right Leg – the 4 knee ligaments**

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#### Cartilage and Menisci

- Articular Cartilage: Smooth tissue covering bone ends
- Menisci: C-shaped discs that cushion and stabilize joint



#### Bony Landmarks for Manual Therapy



#### Muscular Anatomy of the Knee

- Quadriceps group
- Hamstring group
- Adductors
- Calf that cross the knee muscles: gastrocnemius and plantaris
- Also involved but not directly attaching to the knee:
  - Supporting influence from glutes and hip rotators
  - Functional input from foot and ankle musculature

#### **Quadriceps Group & Patellar Tracking**

- Rectus Femoris: Crosses hip and knee, contributes to hip flexion and knee extension
- Vastus Lateralis & Medialis: Key players in lateral/medial tracking of patella
- Vastus Intermedius: Deep to rectus; pure knee extender
- Additional "Quads" (Quints? Sexts?):
  - VMO (Vastus Medialis Oblique)
  - TVI (Tensor Vastus Intermedius)

#### Hamstring Group & Joint Support

- Biceps Femoris (Lateral): Attaches to fibular head, stabilizes against valgus stress
- Very important to remember the shorter 2nd Head that originates in the middle of the femur and also attaches to the fibular head
- Semitendinosus & Semimembranosus (Medial): Influence tibial rotation & medial support



# Vastus medialis oblique muscle



# Biceps Femoris



#### Adductor Group & Medial Knee Support

- Adductor Longus & Brevis: Originate at the pubis and insert along the femur; contribute to medial stability
- Adductor Magnus: Has a hamstring-like posterior portion and deep fascial relationship with the medial quad
- Gracilis: Crosses both hip and knee joints; often overlooked but important for medial knee tracking
- Pectineus: Small muscle that assists in hip adduction, flexion, and medial rotation



#### Sartorius: A Muscle All on It's Own

- Sartorius is neither an adductor, hamstring, or quad but definitely has an affect on the knee in several ways
- It helps to support knee flexion as well as hip adduction and is really the only muscle designed for the specific scenario of knee flexion, hip adduction and internal rotation all happening at once





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#### Gastrocnemius, Soleus, & Popliteal Area

- Gastrocnemius: Crosses knee and ankle; can restrict flexion when tight
- Popliteus: Key muscle in "unlocking" the knee from full extension
- Plantaris: sits under popliteus and 2nd head of biceps femoris; the long tendon that attaches to the calcaneus with a very small muscle belly means very little ability to functionally move either the knee or ankle some physiologist conjecture that it is a "signaling" muscle as opposed to being used for either mobility or stability (might be true for TVI too)
- Manual Caution: Popliteal artery and nerve pass through this space





#### Hip and Foot Contributions to Knee Mechanics

- TFL, Glute Max & Med: Influence femoral rotation and knee tracking
- Deep 6 Rotators: Stabilize femur during weight shifts
- Peroneals, Tibialis Posterior, & Arch Control Muscles: Foot instability often leads to compensatory stress at the knee
- Massage Insight: Fixing the knee often starts at the hip or foot

#### Anatomy Review: Muscles Affecting the Hip Wheel

Deep 6 Group

- Gluteus Minimus
- Piriformis
- Gemellus Superior
- Gemellus Inferior
- Obturator Internus
- Quadratus Femoris









#### **Ideal Knee Alignment**

- Alignment is optimal when the femoral condyles sit centered over the tibial plateau in both static standing and dynamic gait.
- Alignment affects load distribution during walking, squatting, and other weight-bearing actions.
- Therapists should observe for lateral/medial deviation, internal/external rotation, and flexion-extension abnormalities.

#### Varus and Valgus Presentations

- Varus: Bow-legged appearance with knees angling outward can increase medial knee compression.
- Valgus: Knock-kneed stance with knees angled inward can strain MCL and compress lateral structures.
- Evaluate in standing and walking to assess functional vs structural misalignment.

## Valgus vs. Varus Knee Alignments



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### Hypermobility vs Hypomobility

- Hypermobility: Excessive range of motion, often due to lax ligaments may contribute to instability and increased injury risk. Requires PT and strength training to stabilize with massage to integrate and keep ROM
- Hypomobility: Stiffness or restricted ROM that limits functional movement and may cause compensations elsewhere.
- Both states require different treatment and reinforcement strategies.

#### Structural vs Functional Misalignment

- Structural: Bony anomalies or congenital shape causing alignment issues (e.g., tibial torsion, long femur).
- Functional: Muscular imbalances, fascial restriction, or postural habits causing misalignment.
- A good question to ask is the bow or knock knees have been present since childhood (structural) or not (functional)
- Identifying the source changes your treatment approach some patterns are adaptable, others must be managed.
### Lifelong vs Acquired Adaptations

- Lifelong issues often emerge from early development or injury before skeletal maturity.
- Acquired patterns can result from lifestyle, surgeries, injury compensation, or occupational stress.
- History intake and structural observation help differentiate and allow you to more clearly define goals and expected outcomes of massage and other non-surgical interventions.

#### How to Assess Patellar Glide

- Observe patellar position in resting state (midline vs shifted)
- Have client contract quads note movement pattern of patella (upward, medial/lateral)
- Gently move patella medially/laterally with relaxed quads to assess mobility and restriction
- Compare to opposite knee and note symmetry

# VMO Role and Quad Balance

- VMO (Vastus Medialis Oblique) helps pull patella medially during extension
- Weak VMO + dominant Vastus Lateralis = common tracking imbalance
- Look for lateral patellar drift in straight leg raise or extension under load
- Strengthening VMO selectively is difficult requires full-chain rehab approach

# Fascia and IT Band Influence on Tracking

- IT band adhesion to the Vastus Lateralis can keep it from gliding properly and over recruit it causing the lateral fascia to pull the patella laterally
- Chronic overuse in running, cycling, or lateral loading can build fascial tension and adhesions
- Palpate lateral retinaculum and ITB for density and discomfort
- Massage + movement retraining can help rebalance forces

# Knee Anatomy: Lateral Retinaculum

Lateral retinaculum

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# Techniques for Restoring Proper Patellar Motion

- Massage techniques: medial patellar mobilization, lateral fascial release, quad softening
- Supine fascial glide across distal quads and retinaculum
- Educate client on postural influence and dynamic tracking control
- Often improving foot and ankle alignment and mobility can help as well as hip mobility and pelvic position

# ACL/PCL Injuries: Acute Trauma vs Degeneration (It's often both!)

- ACL injuries often result from twisting or sudden impact; PCL more from blunt force to the front of the knee (think car bumper or football tackle)
- ACL injuries are more common and may require surgery
- While ACL tears seem to be a sudden occurrence there is often slow and degenerative breakdown tears that cause gradual instability until the ligament snaps with impact
- Massage can aid in post-op recovery and rebalancing muscular compensations that both existed before the injury and pile up afterwards
- Avoid deep pressure directly near the area early post-injury and within the first few weeks after surgery

#### Meniscus Tears: Medial vs Lateral

- The medial meniscus is generally more load-bearing and more commonly injured through long term degeneration
- Much like an ACL, it often wears down slowly over time then seems to snap suddenly with impact
- Lateral meniscus is often injured in more extreme rotation or impact such as a side swiping impact at knee level (again, cars, sports, skiing, etc)
- Full vs partial tear determines treatment plan
- Avoid joint compression during massage
- Focus on supporting quads, hams, and adductors and look for ways to rebalance and relieve tension on the medial side of the knee

# Cartilage Degradation and Surgical Interventions

- Generally caused by age, overuse, or misalignment can be combined with impact injuries
- Leads to stiffness, pain, and grinding sensations and will eventually lead to a likely knee replacement or resurfacing
- Surgery may involve vacuuming out the joint space to "clean up" or in some cases microfracture to encourage blood flow to the area which can stimulate the growth of new cartilage
- Injectable hyaluronic acid is a newer treatment that offers temporary glide but usually last only 4-6 months (some can get up to 12 months of relief)

# Knee Replacement vs Resurfacing

- Full replacement involves prosthetics on femur and tibia
- Resurfacing retains more native joint material and involves coating the ends of the bones with titanium
- Massage directly post-op focuses on rebalancing the surrounding tissue, not working on the joint directly then slowly introducing direct work as PT helps the client rebuild stability
- Scar tissue needs light, progressive work
- Combine with PT and client movement for best results

# Injectables (e.g. Hyaluronic Acid)

- Lubricates joint space temporarily
- Not a cure best for symptom management
- Effects wear off in 6–12 months
- Avoid direct work over injection site for 48+ hours
- Massage maintains ROM and reduces muscle guarding

### Massage Considerations Post-Surgery

- Address scar tissue gently at first and progressively deeper as the joint gains stability the goal is to keep the tissue moving as much as possible within safe limits to prevent scar tissue locking the area
- Clients may fear re-injury work slowly with clear permission
- Reinforce trust and reintroduce active movement
- Touch and pacing matter as much as technique

# Standing Alignment Assessment with All Students

- Observe from front, side, and back look for knee hyperextension, valgus/varus angles
- Compare tibial tuberosity and patella alignment relative to hips and ankles
- Look for femoral internal or external rotation influencing knee position
- Assess symmetry, muscle tone, and postural loading
- Note compensations in foot, ankle, or hip affecting knee tracking

# Squat Test with Neutral Feet

- Have client perform a slow squat with feet parallel and with hips, knees, and ankles on a plumb line
- Watch for knee collapse inward (valgus) or excessive outward movement (varus)
- Evaluate balance between quads, glutes, and ankle mobility
- Note weight distribution does client favor one side?
- Common deviations offer insight into habitual movement patterns

# Single-Leg Stance and Transitions (Demo & Have Everyone Try)

- Ask client to balance on one leg, shift weight so that foot is on the centerline, lift the knee straight up then down and, then slowly shift to the other
- Observe pelvic control, hip stability, and knee drift
- Look for collapse or overcorrection in foot/ankle
- Useful for identifying weak glute medius or overactive TFL
- Adds challenge to neuromuscular coordination and proprioception

#### Day 1 Wrap-Up: Review + Q&A

- Today was a lot of material and lecture! Whew :)
- Tomorrow with start with a treatment demo in prone and sidelying, then practice in pairs, then lunch
- After lunch, a demo in supine and practice in pairs
- After practice we'll go over some useful homework and self corrective exercises to give to clients

# MFR for the Knee

Day 2

- Observe and practice treatment techniques in prone and sidelying
- Observe and practice treatment techniques in supine
- Learn useful homework that you can give to clients

# Organizing by Position: Prone $\rightarrow$ Side-lying $\rightarrow$ Supine

- Prone: allows easiest access to posterior chain (hamstrings, calves, lateral fascial line)
- Side-lying: easiest access to lateral quad, IT band, and hip rotators with best gravity support for therapist
- Supine: easiest access for quads, adductors, patellar mobilization, and PNF stretching (although there are great ways to work on hamstrings in supine too which we'll learn)
- Choose positions based on client goals, table setup, and mobility limitations with a new client you may want to start in supine both for better ability to talk to and gauge the intensity level of the how they are receiving the work and also some clients may have trouble lying face down with their knees pointed into the table
- You will likely need to be able to work (and should) in all 3 during a recovery series for true long term relief for the client over the course of a series of sessions

# Layer Techniques: Surface $\rightarrow$ Deep $\rightarrow$ Mobility

- For post surgery clients begin with the impacted leg for the first 15-20 minutes and end with broader work to integrate it they will want to know that you won't spend 45 minutes on their back and then only get to the knee at the end
- For more general knee pain clients you can start more broadly then work towards more focus for many of these the knee isn't really the issue it's the rest of the kinetic chain causing improper tracking
- Avoid going deep too soon layering builds trust and effectiveness
- However, spending too much time going "light" and "warming up" will likely frustrate clients as well who will be left wondering "when will they get in there?" - for me "warm up" is maybe a total of a few minutes at the beginning and I'd rather establish quickly that I've got a good sense of pressure that "gets to the right places" but doesn't feel like it might rapidly increase to painful
- Follow with joint mobilization or stretch techniques to integrate gains
- Think in terms of tissue sequencing, not isolated spots

#### **Reassess Before & After Each Session**

- Ask client for feedback: does movement feel easier, more stable?
- Recheck patellar glide, knee tracking, and ROM
- Reassessment guides the next stage of treatment
- Expect ups and downs, especially post knee replacement surgery healing is never a straight line of progress
- Bonus: ask what their PT notices in terms of client improved ROM and ability to do exercises post massage if you are doing the right things they'll usually call you a magician (it's science though...)

#### Blend Modalities into a Cohesive Flow

- Combine fascial release, trigger point work, and PNF stretching
- Transition between techniques smoothly avoid abrupt position changes of the knee itself and be very cognizant of not rotating the lower leg in comparison to the upper leg
- Treat the body as an integrated system, not isolated zones PT will be heavily focused just on the knee so you should see your job as integrating the knee back into the whole
- Leave time to balance both sides of the body though the non-injured side will only need about 1/4 of the work to feel balanced

(This assumes client is comfortable lying face down and not early in recovery for a knee replacement)

- First, open with quick back sequence followed by work to improve femoral position in the hip socket
- Fascial release of spinae erectors down to QL
- QL and obliques fascial release
- Gluteus maximus fascial release
- Gluteus medius fascial release
- Piriformis fascial release

- Fascial release of each hamstring with lower leg resting
- Deeper release of hamstrings using forearm/elbow with knee bent and resting on your shoulder to allow for additional movement of the joint (if client ROM allows and not within the first 6-8 weeks post knee replacement)
- Separate hamstring and gastroc tendons to allow them to better glide against each other using hooks thumbs on the inside of the medial and lateral tendon "Xs" making sure to avoid popliteal space by having all pressure move away towards the condyles
- Advanced version has client holding their own lower leg vertically and slowly lowering it while you hold the tendons as above

- Check for lateral rotation of the lower leg as compared to the upper leg (you may need to adjust the femur so that the knee is pointing straight down first)
  if present than definitely work on the 2nd head of biceps femoris
- To find the 2nd head, lift the lower leg to vertical to create slack in the hamstrings
- Find the tendon of the long head and the ITB between those is a "pocket"
- Using a thumb or first two fingers, slide into the pocket and underneath the long head tendon and press down towards the lateral edge of the femur to contact the 2nd head muscle belly (it does not take much pressure here to produce a 7-8 level feeling of intensity)

- The easiest technique to use when first working on the 2nd head is pin and stretch, ie pin the muscle belly to the femur with your thumb while slowly and easily lowering and raising the lower leg with your other hand
- Once you get much more comfortable with finding it, you can trace the muscle up to the upper attachment on the linea aspera and add in a fascial stroke from the upper attachment down towards the insertion on the head of the fibular
- You can also lower and lift the lower leg as you do this and also gently twist the lower leg into lateral and medial rotation to further pin and stretch the muscle

- You can potentially repeat this technique on plantaris by moving closer to the knee and a bit medially
- To check if you've pinned plantaris down ask the client to point their foot which should slightly contract plantaris under your fingers/thumb
- Be very deliberate with pressure, a little goes a long way here
- Not everyone is loose enough in this space of the lateral back of the knee to get at plantaris

- Sliding down and lateral, you can pin the popliteus muscle attachment at the upper part of the condyle and pin and stretch this as well
- Distinguishing this muscle from surrounding muscles in this position is difficult as it will be shortened and slack
- Lastly, working in the upper calf can be quite productive even with muscles that don't technically cross the knee as these will often adhere to the muscles that do cross the knee

- While the foot & ankle CEU class goes for more into depth on the lower leg there is a simple and great technique that can help get these muscles to glide better and unstick from the knee muscles
- With the lower leg bent and vertical, slide your fingers into the space behind gastroc and soleus on either side of the lower leg and ask the client to point and flex their ankle
- You can add in some gentle flexion and extension of the lower leg while they do this to help both the tissue and the brain better learn to act independently

# Sidelying Release for TFL

- Fascially release TFL by finding tight areas in the anterior part of the triangle from greater trochanter to pelvic crest and using pin and stretch technique use elbow to pin point and ask client to move femur towards ceiling (and/or nose) *without* changing pelvic position from neutral
- Repeat on several found "stuck" points until client is able to move femur without needing to recruit QL and obliques

# Sidelying Release for Vastus Lateralis, and Additional Ways to Access 2nd Head of Biceps Femoris

- Fascially release the lateral upper leg from knee to hip while asking client to slowly straighten and bend the lower leg in small increments
  they don't need to fully extend or flex, just small movements to help engage vastus lateralis to help ITB glide better across it
- Repeat 2nd head of biceps femoris techniques in this position with client moving the lower leg instead of you in small increments (see above) - make sure they don't move the lower leg so far that it's off of the bolster as this may put too much torque on the joint

# Proposed Treatment Sequence: Supine Release of Hip Wheel, Pelvic Floor, Abdominals, and Iliopsoas

- Fascially release ITB from hip to knee
- Fascially release septum between vastus lateralis and rectus femoris from hip to knee
- Fascially release rectus femoris from knee to AIIS
- Drape around hip and abduct leg with bent knee, resting client's leg on yours while sitting on the table (use chair to balance your foot to make this easier)
- Fascially release adductor magnus from knee towards hip
- Fascially release adductor longus from knee towards hip

# Proposed Treatment Sequence: Supine Release of Hip Wheel, Pelvic Floor, Abdominals, and Iliopsoas

- Lift lower leg up and rest on your shoulder while sitting in same position as adductor work
- Use elbow point to fascially release semitendinosus
- Use elbow point to fascially release membranosus
- Stand and use soft fist to fascially release biceps femoris
- Use elbow point to fascially release lower triangle of gluteus maximus

# Triple Hinge Joint PNF Stretch to help leg alignment

- Bend client's knee and hip to place their foot against your chest (or use hands from side of table) and stretch, hinging ankle, knee and hip towards end range of motion but not all the way
- Ask the client to "leg press" into your resistance while making sure the knee doesn't medially or laterally shift for a count of 5
- Feel for which of the 3 hinges feels most stuck and cue the client to focus on hinging better there (often the ankle)
- After the 5 count ask them to relax
- Do not immediately try to further into the stretch...wait a few seconds and you should feel the whole leg relax and "allow" you to hinge each of the joints further without having to work hard...this is the brain realizing the it has more ROM than it thinks and letting go of protection (much more valuable than you pushing into the stretch)
- Guide into a deep stretch slowly and easily without trying to push all the way to the end range

### Hamstring PNF Stretch

- Straighten client's leg and stretch upwards towards end range of motion but not all the way
- Ask the client to try to scissor their leg back onto the table into your resistance while making sure the hip doesn't lift off the table for a count of 5
- After the 5 count ask them to relax
- Do not immediately try to further into the stretch...wait a few seconds and you should feel the whole leg relax and "allow" you to lift the leg further without having to work hard...this is the brain realizing the it has more ROM than it thinks and letting go of protection (much more valuable than you pushing into the stretch)
- Guide into a deep stretch slowly and easily without trying to push all the way to the end range of motion

# Proposed Treatment Sequence: Supine Release of Hip Wheel, Pelvic Floor, Abdominals, and Iliopsoas

Advanced Releases (Psoas Release)

- Starting at belly button, shift away from midline about 1.5 inches to find edge of the rectus abdominis muscle
- Slightly more laterally there will be a "pocket" between the layers of the obliques and rectus abdominis
- Using straight fingers or a thumb, sink into the pocket at a slight angle towards the lumbar vertebrae
- Use other hand to gently rock leg internally and externally in the hip socket
- If you are correctly placed, you should feel psoas shifting back and forth under your fingers use pin and stretch technique to release

# Proposed Treatment Sequence: Supine Release of Hip Wheel, Pelvic Floor, Abdominals, and Iliopsoas

Advanced Releases (Iliacus Release)

- Starting at ASIS, shift towards the midline just to the inside of the ASIS
- Using straight fingers or a thumb, sink down and laterally to contact edge of iliacus on the "bowl" of the front of the pelvis
- Use other hand to gently rock leg internally and externally in the hip socket
- If you are correctly placed, you should feel iliacus shifting back and forth under your fingers and/or you may see the femur flex in the hip socket to raise the knee slightly use pin and stretch technique to release iliacus
- Practice in pairs with 1 hour per person
- Break for lunch

## **Client Homework Practices**

- Standing slow squats with feet in neutral (as opposed to standard gym squat with feet spread and pointing slightly out)
- Single leg balance exercise
- Active release deep quad stretch on massage table or couch
- Self release for 2nd head of biceps femoris

## How to Get Access to Slides, Videos, and Certificates

- Julia will give me a list of everyone's emails from this course
- When I get back to NYC, I'll create a course page on our website where these materials will be stored and add all participants
- There will be instructions within the course for how to get a copy of your completion certificates
- Please give me about 3-5 days to get this set up :)