

Knee Injury Medical Treatment Guidelines[©]

**Proposed by the
State of New York
Department of Insurance
to the
Workers' Compensation Board**



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Knee Injury

Medical Treatment Guidelines

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A. INITIAL DIAGNOSTIC PROCEDURES

1. **HISTORY TAKING AND PHYSICAL EXAMINATION** establish the foundation/basis for and dictate subsequent stages of diagnostic and therapeutic procedures. When findings of clinical evaluations and those of other diagnostic procedures are not complementing each other, the objective clinical findings should have preference. The medical records should reasonably document the following.

- a. **History of Present Injury:**

- i. Mechanism of injury. This includes details of symptom onset and progression, and symptoms that may arise from postural or functional accommodation to the knee injury;
- ii. Relationship to work. This includes a statement of the probability that the illness or injury is work-related;
- iii. Prior occupational and non-occupational injuries to the same area including specific prior treatment and any prior bracing devices;
- iv. History of locking, clicking, giving way, acute or chronic swelling, crepitation, pain while ascending or descending stairs, or popping;
- v. Ability to perform job duties and activities of daily living; and
- vi. Exacerbating and alleviating factors for symptoms; not limited to the knee.

- b. **Past History:**

- i. Past medical history includes, but is not limited to, neoplasm, gout, arthritis, and diabetes;
- ii. Review of systems includes, but is not limited to, symptoms of rheumatologic, neurologic, endocrine, neoplastic, and other systemic diseases;
- iii. Smoking history;
- iv. Vocational and recreational pursuits;
- v. Prior imaging studies; and

vi. Past surgical history.

c. **Physical Examination:** Examination of a joint should include the joint above and below the affected area. Physical examinations should include accepted tests and exam techniques applicable to the joint or area being examined, including:

i. Visual inspection;

ii. Palpation;

iii. Range of motion/quality of motion;

iv. Strength;

v. Joint stability;

vi. If applicable to injury, integrity of distal circulation, sensory, and motor function; and

vii. If applicable, full neurological exam including muscle atrophy and gait abnormality.

2. **RADIOGRAPHIC IMAGING** should not be routinely performed. The mechanism of injury and specific indications for the radiograph should be listed on the request form to aid the radiologist and x-ray technician. Indications include:

a. The inability to transfer weight for four steps at the time of the initial visit, regardless of limping;

b. History of significant trauma, especially blunt trauma or fall from a height;

c. Age over 55 years;

d. Unexplained or persistent pain over two weeks. (Occult fractures, especially stress fractures, may not be visible on initial x-ray. A follow-up radiograph and/or bone scan may be required to make the diagnosis);

e. History or exam suggestive of intravenous drug abuse or osteomyelitis; and

f. Pain with swelling and/or range of motion (ROM) limitation localizing to an area of prior fracture, internal fixation, or joint prosthesis.

3. **LABORATORY TESTS** are rarely indicated at the time of initial evaluation, unless there is suspicion of systemic illness, infection, neoplasia, connective tissue disorder, or underlying arthritis or rheumatologic disorder based on history and/or physical examination. Laboratory tests can provide useful diagnostic information. Tests include, but are not limited to:
- a. Complete Blood Count (CBC) with differential can detect infection, blood dyscrasias, and medication side effects;
 - b. Erythrocyte sedimentation rate, rheumatoid factor, Antinuclear Antigen (ANA), Human Leucocyte Antigen (HLA), and C-reactive protein (CRP) can be used to detect evidence of a rheumatologic, infection, or connective tissue disorder;
 - c. Serum calcium, phosphorous, uric acid, alkaline phosphatase, and acid phosphatase can detect metabolic bone disease;
 - d. Liver and kidney function may be performed for prolonged anti-inflammatory use or other medications requiring monitoring; and
 - e. Analysis of joint aspiration for bacteria, white cell count, red cell count, fat globules, crystalline birefringence and chemistry to evaluate joint effusion.

4. **OTHER PROCEDURES**

- a. **Joint Aspiration:** is a procedure used when specifically indicated and performed by individuals properly trained in these techniques. This is true at the initial evaluation when history and/or physical examination are of concern for a septic joint or bursitis. Aspiration should not be performed through an infected area.

Particularly at the knee, aspiration of a large effusion can help to decrease pain and speed functional recovery. Persistent or unexplained effusions may be examined for evidence of infection, rheumatologic, or inflammatory processes. The presence of fat globules in the effusion strongly suggests occult fracture. A large hemorrhagic effusion should prompt suspicion that a fracture may be present.

Algorithm 1: Initial Evaluation of Occupational Knee Complaints

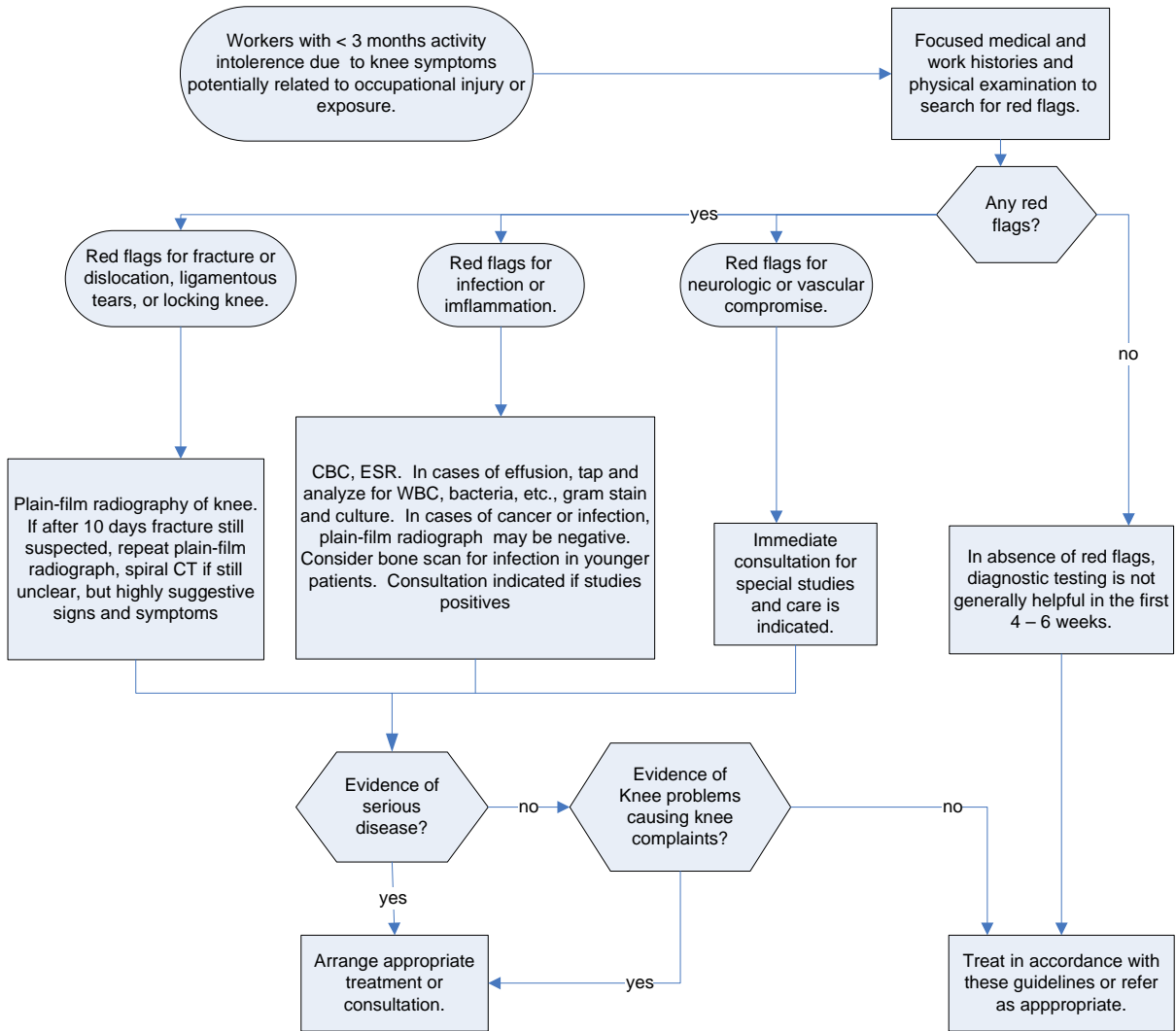


Table 1: Red Flags for Potentially Serious Knee Conditions

Disorder	Medical History	Physical Examination
Fractures	History of significant trauma	Bony crepitation Abnormal mobility Angulation of leg New deformity Point tenderness Inability to bear weight or walk
Dislocations	History of significant trauma Prior history of dislocation	Displaced patella Displaced tibia or fibula New deformity
Septic arthritis	Penetrating wound of the knee History of systemic infection Diabetes History of immunosuppression (e.g., transplant, chemotherapy, HIV)	Severe pain on motion Systemic signs of infection Local swelling and heat Abnormal complete blood count (CBC), erythrocyte sedimentation rate (ESR) Soft tissue swelling not consistent with effusion Joint effusion
Infected prepatellar bursitis	Minor trauma to prepatellar bursa area	No severe pain on motion Spreading local inflammation and cellulitis Prepatellar effusion
Inflammation	History of autoimmune disease or gout Recurrent episodes swollen joint Swelling in other joints	Local effusion, heat CBC, ESR may be abnormal Pain on motion
Tumor	History of primary tumor or metastatic disease	Local swelling Nontender mass

Table 1: (cont'd)

Disorder	Medical History	Physical Examination
Compartment syndrome above or below the knee	<p>History of fracture or other major trauma</p> <p>Very painful muscular compartment</p>	<p>Tense, very tender compartment</p> <p>Possibly distal signs of neurovascular compromise</p>
Neurovascular compromise	<p>History consistent with fracture or dislocation</p> <p>History of peripheral vascular disease</p> <p>History of diabetes</p> <p>Pain, pallor at or below the knee</p> <p>History of recent surgery, immobilization, or deep vein thrombosis</p>	<p>Decreased or absent pulse popliteal or pedal</p> <p>Pale, cold skin, distal to knee</p> <p>Paralysis of the distal lower extremity</p> <p>Painless swelling (Charcot's syndrome)</p> <p>Painful swelling in popliteal fossa or lower leg</p>
Compartment syndrome above or below the knee	<p>History of fracture or other major trauma</p> <p>Very painful muscular compartment</p>	<p>Tense, very tender compartment</p> <p>Possibly distal signs of neurovascular compromise</p>

Table 2: Diagnostic Criteria for Non-Red Flag Knee Conditions

Probable Diagnosis or Injury	Mechanism	Unique Symptoms	Unique Signs	Tests and Results
Meniscus tear	Squatting Twisting with foot Planted (in younger workers) Repeated minor trauma (in older workers)	Locking of knee with flexion Buckling Mild effusion Apley Test McMurray Test	Catching or locking of knee Quadriceps wasting (rare in acute phase)	MRI confirms tear (test indicated only if surgery is contemplated)
Collateral ligament	Twisting Direct lateral or Medial blow to the knee	Pain at lateral or medial side of knee	Excessive abduction or adduction at knee (>30°) vs. other side when varus and valgus stress (pressure) is applied Tenderness at joint line Tenderness at origin, insertion of ligament	Stress films (not recommended but may be available) show ≥ 7 -mm gap vs. other knee MRI can also confirm tear
Anterior cruciate tear	Noncontact pivot or twist of knee Direct blow to planted leg	Popping sound at injury site Immediate swelling Increased laxity	Positive Lachman's or anterior drawer sign Positive pivot-shift sign Hemarthrosis Acute knee effusion	Arthrometer reading 3 mm > that for other knee MRI confirms tear
Posterior cruciate tear	Blow to front of knee Severe injury of other structure with knee dislocation	Pain interior knee	Positive posterior drawer test Sag sign positive Hemarthrosis Acute knee effusion	Arthrometer reading 2 mm > than for other knee MRI confirms tear
Collateral ligament strain	Direct medial or lateral blow	Pain in lateral or medial knee with pain worse on weight bearing or rotation	Tenderness at joint lines laterally or medially with adduction or abduction Tenderness at origin or insertion of ligament	None
Cruciate ligament strain	Non-contact pivot or twist of knee Direct blow to planted leg	Pain in interior knee	Pain but not displacement elicited by drawer and/or Lachman test	None

Table 2: (cont'd)

Probable Diagnosis or Injury	Mechanism	Unique Symptoms	Unique Signs	Tests and Results
Patellofemoral syndrome	Chronic vibration, impact Direct blow to patella Overuse	Popping or snapping Pain under patella with motion Pain on stairs, hills, quadriceps contraction	Tenderness under patella Grating under patella on motion	Possible misalignment on Merchant's view, with lateral displacement (indicated only if surgery is contemplated)
Effusion, nonspecific	No history of acute trauma	Effusion may be worse with exercise	Effusion Patellar Ballottement and Fluid Shift	Possible crystals in aspirate Possible positive serology for rheumatic disease
Patellar tendinitis	Repeated minor trauma	Pain over patellar tendon	Tenderness over patellar tendon Pain on resisted quadriceps contraction	MRI is confirmatory (but not necessary except when considering surgery)
Patellar bursitis	Repeated minor trauma from kneeling work	Swelling over patella Inability to knee due to swelling	Prepatellar bursal effusion	Aspirate positive for bacteria, etc., if infected
Nonspecific pain	Nonspecific No acute trauma	None	None	None
Patellar instability	Nonspecific	Knee catching, semilocking, swelling, constant dull pain	Abnormal patellar motion	None

B. SPECIFIC KNEE INJURY DIAGNOSES, TESTING, AND TREATMENT

1. CHONDRAL DEFECTS:

- i. Description/Definition: Cartilage or cartilage and bone defect at the articular or meniscal surface of a joint.
- ii. Mechanism of Injury: Usually caused by a traumatic knee injury.
- iii. Specific Physical Findings: Knee effusion, pain in joint.
- iv. Diagnostic Testing Procedures: MRI may show bone bruising, osteochondral lesion, or possibly articular cartilage injury. Radiographs and CT may also be used. Following an acute injury an MRI usually shows bone bruising.
- v. Non-Operative Treatment: Limited indications. The size and extent of the injury should be determined first. This form of therapy is reserved for non-displaced, stable lesions. Immobilization (for acute injury), active and/or passive therapy.
- vi. Surgical Indications/Operative Treatment: Chondroplasty, Osteochondral Autograft (OATS) Procedure and Autologous Chondrocyte Implantation (ACI). Refer to Tables 3, 4, 5.
- vii. Post-Operative Therapy: May include restricted weight-bearing, bracing, active and/or passive therapy. Continuous passive motion is suggested after microfracture.

Table 3: Chondroplasty/Subchondral Drilling

PROCEDURE	CONSERVATIVE CARE	SUBJECTIVE	OBJECTIVE	IMAGING
<p>CHONDROPLASTY (Shaving or debridement of an articular surface)</p>	<p>Medication OR Physical Therapy</p>	<p>AND Joint pain AND Swelling</p>	<p>AND Effusion OR Crepitus OR Limited ROM</p>	
<p>SUBCHONDRAL DRILLING OR MICROFRACTURE</p>	<p>Medication OR Physical Therapy</p>	<p>AND Joint pain AND Swelling</p>	<p>AND Small full thickness chondral defect on the weight bearing portion of the medial or lateral femoral condyle AND Knee is stable with intact, fully functional menisci and ligaments AND Normal joint space AND Ideal age 45 or younger</p>	<p>AND Chondral defect on the weight bearing portion of the medial or lateral femoral condyle on: MRI OR Arthroscopy</p>

Table 4: Osteochondral Autograft (OATS Procedure)

PROCEDURE	CONSERVATIVE CARE	SUBJECTIVE	OBJECTIVE	IMAGING
<p>OSTEOCHONDRAL AUTOGRAFT (MOSAICPLASTY OR OATS PROCEDURE)</p>	<p>Medication OR Physical Therapy</p>	<p>AND Joint pain AND Swelling</p>	<p>AND Failure of previous subchondral drilling or microfracture Large full Thickness chondral defect that measures less than 3 cm in diameter and 1 cm in bone depth on the weight bearing portion of the medial or lateral femoral condyle AND Knee is stable with intact, fully functional menisci and ligaments AND Normal knee alignment AND Body mass index of less than 35</p>	<p>AND Chondral defect on the weight bearing portion of the medial or lateral femoral condyle on: MRI OR Arthroscopy</p>

Body Mass Index (BMI): The equation for calculating the BMI = (Weight in pounds ÷ by height in inches divided ÷ by height in inches) x 703. For example, a person weighing 210 pounds and 6 feet tall would have a BMI of 210 pounds ÷ by 72 inches ÷ by 72 inches) x 703=28.5.

Table 5: Autologous Chondrocyte Implantation (ACI)

PROCEDURE	CONSERVATIVE CARE	SUBJECTIVE	OBJECTIVE	IMAGING
<p>AUTOLOGOUS CHONDROCYTE IMPLANTATION (ACI)</p>	<p>Physical therapy for a minimum of 2 months</p>	<p>Patient is capable and willing to follow the rehabilitation protocol.</p>	<p>Failure of traditional surgical interventions (i.e., microfracture, drilling, abrasion, osteochondral graft). Debridement alone does not constitute a traditional surgical intervention for ACI.</p> <p>AND</p> <p>Single, clinically significant, lesion that measures between 1 to 10 sq. cm in area that affects a weight-bearing surface of the medial femoral condyle or the lateral femoral condyle.</p> <p>AND</p> <p>Full-thickness lesion (Modified Outerbridge Grade III-IV) that involves only cartilage</p> <p>AND</p> <p>Knee is stable with intact, fully functional menisci and ligaments.</p> <p>AND</p> <p>Normal knee alignment</p> <p>AND</p> <p>Normal joint space</p> <p>AND</p> <p>Patient is less than 60 years old</p> <p>AND</p> <p>Body Mass Index of less than 35.</p>	<p>Chondral defect on the weight bearing surface of the medial or lateral femoral condyle on:</p> <p>MRI</p> <p>Or</p> <p>Arthroscopy</p>

Table 5 (cont'd):

ACI Exclusion Criteria

ACI is not a covered procedure in any of the following circumstances:

- Lesion that involves any portion of the patellofemoral articular cartilage, bone, or is due to osteochondritis dissecans.
- A “kissing lesion” or Modified Outerbridge Grade II, III, or IV exists on the opposite tibial surface.
- Mild to severe localized or diffuse arthritic condition that appears on standing x-ray as joint space narrowing, osteophytes, or changes in the underlying bone.
- Unhealthy cartilage border; the synovial membrane in the joint may be used as a substitute border for up to ¼ of the total circumference.
- Prior total meniscectomy of either compartment in the affected knee. Must have at least 1/3 of the posterior meniscal rim.
- History of anaphylaxis to gentamycin or sensitivity to materials of bovine origin.
- Chondrocalcinosis is diagnosed during the cell culture process.

Modified Outerbridge Classification

I	Articular cartilage softening
II	Chondral fissures or fibrillation < 1.25 cm in diameter
III	Chondral fibrillation > 1.25 cm in diameter, (“crabmeat changes”)
IV	Exposed subchondral bone

2. AGGRAVATED OSTEOARTHRITIS:

- i. Description/Definition: Swelling and/or pain in a joint due to an aggravating activity in a patient with pre-existing degenerative change in a joint.
- ii. Mechanism of Injury: May be caused by repetitive activity or constant position.
- iii. Specific Physical Findings: Increased pain and swelling in a joint.
- iv. Diagnostic Testing Procedures: Radiographs
- v. Non-Operative Treatment: NSAIDs, ice, bracing, active and/or passive therapy, therapeutic injections, which may include hyaluronate therapy, restricted activity.

- vi. Surgical Indications/Operative Treatment: Symptoms not responsive to conservative therapy.

Debridement with or without removal of loose bodies.
Arthroscopic joint lavage is not recommended.

For symptoms not responsive to conservative measures, treatment may involve total joint replacement. Refer to Table 11.

- viii. Post-Operative Therapy: Active and/or passive therapy.

3. COLLATERAL LIGAMENT INJURY:

- i. Description/Definition: Spain/strain or rupture of the medial or lateral collateral ligament. Injury of the medial collateral ligament may also be associated with a concomitant medial meniscus injury.
- ii. Mechanism of Injury: Valgus or varus trauma force applied to the knee.
- iii. Specific Physical Findings: Medial-lateral instability (knee should be tested in slight flexion), tenderness over medial or lateral collateral ligament which increases with valgus or varus force applied to the knee.
- iv. Diagnostic Testing Procedures: MRI may be indicated for suspected Grade II or Grade III tears.
- v. Non-Operative Treatment: Isolated Grade I collateral ligament tears and many Grade II tears have been shown to heal with excellent results without surgical intervention, When accompanying cruciate or meniscus injuries are ruled out, the patient can be treated non-operatively. Conservative management with casting, orthotics and rehabilitation may be indicated.
- vi. Surgical Indications/Operative Treatment: A complete Grade III collateral ligament tear should be referred to an orthopedic surgeon.

4. ANTERIOR CRUCIATE LIGAMENT (ACL) INJURY:

- i. Description/Definition: Rupture or partial rupture of the anterior cruciate ligament; may be associated with other internal derangement of the knee.
- ii. Mechanism of Injury: May be caused by virtually any traumatic force to the knee but most often caused by a twisting or a hyperextension force.
- iii. Specific Physical Findings: Findings on physical exam include effusion or hemarthrosis, instability, Lachman's test, pivot shift test, and anterior drawer test.
- iv. Diagnostic Testing Procedures: MRI. Radiographs may show avulsed portion of tibial spine but this is a rare finding.
- v. Non-Operative Treatment: Active and/or passive therapy, bracing, therapeutic injection.
- vi. Surgical Indications/ Operative Treatment: Refer to Table 6.
- vii. Post-Operative Therapy: Active and/or passive therapy, bracing.

Table 6: Anterior Cruciate Ligament Repair

PROCEDURE	CONSERVATIVE CARE	Clinical Findings		
		SUBJECTIVE	OBJECTIVE	IMAGING
ANTERIOR CRUCIATE LIGAMENT (ACL) REPAIR	AND AND AND			
	<p>In the presence of a complete tear in a patient for whom surgical repair is contemplated, a course of conservative treatment need not be completed prior to surgery.</p> <p>Physical therapy</p> <p>OR</p> <p>Brace</p>	<p>Pain alone is not an indication for surgery</p> <p>Instability of the knee, described as “buckling or give way”</p> <p>OR</p> <p>Significant effusion at the time of injury</p> <p>OR</p> <p>Description of injury indicates rotary twisting or hyperextension incident</p>	<p>Positive Lachman’s sign</p> <p>OR</p> <p>Positive pivot shift</p> <p>OR</p> <p>Positive anterior drawer</p> <p>OR</p>	<p>(Not required if acute effusion, hemarthrosis, and instability; or documented history of effusion, hemarthrosis and instability)</p> <p>ACL disruption on:</p> <p>MRI</p> <p>OR</p> <p>Arthroscopy</p> <p>OR</p> <p>Arthrogram</p>

5. POSTERIOR CRUCIATE LIGAMENT (PCL) INJURY:

- i. Description/Definition: Rupture of PCL; may have concurrent ACL rupture.
- ii. Mechanism of Injury: Most often caused by a posterior directed force to flexed knee.
- iii. Specific Physical Findings: Findings on physical exam include acute effusion, instability, reverse Lachman’s test, reverse pivot shift, posterior drawer test.
- iv. Diagnostic Testing Procedures: MRI, radiographs may reveal avulsed bone.
- v. Non-Operative Treatment: Active and/or passive therapy, bracing, therapeutic injection.

- vi. Surgical Indications: Complaints of instability. Carefully consider the patients' normal daily activity level before initiation of surgical intervention. Most commonly done when the PCL rupture is accompanied by multiligament injury.
- vii. Operative Treatment: Autograft or allograft reconstruction.
- viii. Post-Operative Therapy: Active and/or passive therapy, bracing.

6. MENISCUS INJURY:

- i. Description/Definition: A tear, disruption, or avulsion of medial or lateral meniscus tissue.
- ii. Mechanism of Injury: Trauma to the menisci from rotational, shearing, torsion, and/or impact injuries.
- iii. Specific Physical Findings: Patient describes a popping, tearing, or catching sensation. Findings on physical exam may include joint line tenderness, locked joint, or occasionally, effusion.
- iv. Diagnostic Testing Procedures: Radiographs including standing Posterior/Anterior (PA), lateral, tunnel, and Skyline views.
- v. Non-Operative Treatment: Active and/or passive therapy, bracing. Trial of manipulation may be attempted for a locked knee. Clinical response should be seen within 2-3 treatments.
- vi. Surgical Indications/ Operative Treatment: Meniscectomy/Meniscus Repair and Meniscal Allograft Transplantation. Refer to Tables 7 and 8.
- vii. Post-Operative Therapy: Active and/or passive therapy, bracing.

Table 7: Meniscectomy/Meniscus Repair

PROCEDURE	CONSERVATIVE CARE	SUBJECTIVE	OBJECTIVE	IMAGING
Meniscectomy OR Meniscus Repair	<p style="text-align: center;">AND</p> <p>In the presence of a locked knee, in a patient for whom surgical repair is contemplated, a course of conservative treatment need not be performed prior to surgery</p> <p>Physical therapy</p> <p>OR</p> <p>Medication</p> <p>OR</p> <p>Activity modification</p>	<p style="text-align: center;">AND</p> <p>Joint pain</p> <p>OR</p> <p>Swelling</p> <p>OR</p> <p>Feeling of give way</p> <p>OR</p> <p>Locking, clicking or popping</p>	<p style="text-align: center;">AND</p> <p>Positive Mc Murray's sign</p> <p>OR</p> <p>Joint line tenderness</p> <p>OR</p> <p>Effusion</p> <p>OR</p> <p>Limited range of motion</p> <p>OR</p> <p>Locking, clicking, or popping</p> <p>OR</p> <p>Crepitus</p>	<p>(Not required for locked knee)</p> <p>Meniscal tear on MRI (Surgical Repair of Grade I tear is not indicated except in unusual circumstances)</p>

Table 8: Meniscal Allograft Transplantation

PROCEDURE	CONSERVATIVE CARE	SUBJECTIVE	OBJECTIVE	IMAGING
<p>MENISCAL ALLOGRAFT TRANSPLANTATION</p>	<p>Physical therapy OR NSAID OR Activity modification</p>	<p>Capable and willing to follow the rehabilitation protocol AND Knee pain that has not responded to conservative treatment</p>	<p>Previous meniscectomy with at least two-thirds of the meniscus removed AND If Modified Outerbridge Scale Graft III then debridement must first produce an articular surface sufficiently free of irregularities to maintain the integrity of the transplanted meniscus AND Stable knee with intact ligaments, normal alignment, and normal joint space. AND Ideal age 20-45 years (too young for total knee) AND Body Mass Index of less than 35</p>	<p>Articular cartilage in the affected compartment demonstrates a chondrosis classified by the Modified Outerbridge Scale as Grade I, Grade II or Grade III</p>

Table 8 (cont'd):

MENISCAL ALLOGRAFT TRANSPLANTATION EXCLUSION CRITERIA

Meniscal Allograft Transplantation is not a covered procedure in any of the following circumstances:

- Mild to severe localized or diffuse arthritic condition that appears on standing x-ray as joint space narrowing, osteophytes or changes in the underlying bone.
- Articular cartilage in the affected compartment demonstrates a chondrosis classified by the Modified Outerbridge Scale as Grade III that has not undergone debridement; Grade III with debridement that has not produced an articular surface that can maintain the integrity of the transplanted meniscus; or Grade IV.

Modified Outerbridge Classification

I	Articular cartilage softening
II	Chondral fissures or fibrillation < 1.25 cm in diameter
III	Chondral fibrillation > 1.25 cm in diameter, ("crabmeat changes")
IV	Exposed subchondral bone

Body Mass Index (BMI): The equation for calculating the BMI = (Weight in pounds ÷ by height in inches divided ÷ by height in inches) x 703. For example, a person weighing 210 pounds and 6 feet tall would have a BMI of 210 pounds ÷ by 72 inches ÷ by 72 inches) x 703=28.5.

7. PATELLAR SUBLUXATION:

- i. Description/Definition: An incomplete subluxation or dislocation of the patella. Recurrent episodes can lead to subluxation syndrome that can cause frank dislocation of the patella.
- ii. Mechanism of Injury: Primarily associated with contusion, lateral force direct contact. Secondary causes associated with shearing forces on the patella.
- iii. Specific Physical Findings: Patient may report buckling sensation. Findings on physical exam may include retinacular weakness, swelling, effusion, marked pain with patellofemoral tracking/compression and glides. In addition, other findings include atrophy of muscles, positive patellar apprehension test, patella alta.
- iv. Diagnostic Testing Procedures: Radiographs including Merchant views, Q-angle versus congruents.
- v. Non-Operative Treatment: Active and/or passive therapy, bracing, therapeutic injection.

- vi. Surgical Indications: Symptoms not responsive to conservative therapy, fracture, recurrent subluxation or recurrent effusion.
- vii. Operative Treatment: Open reduction internal fixation with fracture. Following a patellar dislocation, surgical consultation no sooner than 4-6 months of conservative therapy. Retinacular release, quadriceps reefing, and patellar tendon transfer should only be considered after a minimum of 4 to 5 months of conservative therapy.
- viii. Post-Operative Therapy: Active and/or passive therapy, bracing.

8. RETROPATELLAR PAIN SYNDROME (CHONDROMALACIA PATELLA):

- i. Description/Definition: A retropatellar pain syndrome lasting over three months. Retropatellar pathologies are associated with resultant weakening instability, and pain of the patellofemoral mechanism. Can include mal-alignment, persistent quadriceps tendinitis, distal patellar tendinitis, patellofemoral arthrosis, and symptomatic plica syndrome.
- ii. Mechanism of Injury: May be associated with contusion, repetitive patellar compressive forces, shearing articular injuries associated with subluxation or dislocation of patella, fractures, infection, and connective tissue disease.
- iii. Specific Physical Findings: Patient complains of pain, instability and tenderness that interfere with daily living and work functions. Findings on physical exam may include retinacular tenderness, pain with patellar compressive ranging, positive patellar glide test, atrophy of quadriceps muscles, positive patellar apprehensive test. Associated anatomical findings may include increased Q angle; rotational lower extremity joints; ligament laxity, and effusion.
- iv. Diagnostic Testing Procedures: Radiographs including tunnel, Merchant, or Laurin views. MRI rarely identifies pathology. Occasionally or bone scan.
- v. Non-Operative Treatment: Active and/or passive therapy, bracing, orthotics, therapeutic injections.

- vi. Surgical Indications: Symptoms not responsive to conservative therapy patellar tendon disruption, quadriceps tendon rupture/avulsion, fracture. There are very limited data on long term outcomes of surgical treatment for anterior knee pain. Surgical intervention should be considered after failure of a comprehensive rehabilitation program that has included quadriceps strengthening.
- vii. Operative Treatment: Arthroscopic debridement of articular surface, plica, synovial tissue, loose bodies, arthrotomy, open reduction internal fixation with fracture, patellar button (prosthesis) with grade III-IV osteoarthritis (modified Outerbridge classification) and possible patellectomy. Retinacular release, quadriceps reefing, and tibial transfer procedures should only be considered after 6 to 9 months of conservative therapy. Refer to Table 9.
- viii. Post-Operative Therapy: Active and/or passive therapy; bracing.

Table 9: Lateral Retinacular Release, Patellar Tendon Realignment, Maquet Procedure

PROCEDURE	CONSERVATIVE CARE	Clinical Findings		
		SUBJECTIVE	OBJECTIVE	IMAGING
LATERAL RETINACULAR RELEASE OR PATELLAR TENDON REALIGNMENT OR MAQUET PROCEDURE	Physical therapy (not required for acute patellar dislocation with associated intra-articular fracture) OR Medications	AND Knee pain with sitting OR Pain with patellar/femoral movement OR Recurrent dislocations	AND Lateral tracking of the patella OR Recurrent effusion OR Patellar apprehension OR synovitis with or without crepitus OR Increased Q angle > 15 degrees	AND Abnormal patellar tilt on: x-ray or MRI

9. TENDINITIS/TENOSYNOVITIS:

- i. Description/Definition: Inflammation of the lining of the tendon sheath or of the enclosed tendon. Usually occurs at the point of insertion into bone or a point of muscular origin. Can be associated with bursitis, or calcium deposits or systemic connective diseases.
- ii. Mechanism of Injury: May be caused by extreme or repetitive trauma, strain, or excessive unaccustomed exercise or work.
- iii. Specific Physical Findings: Involved tendons may be visibly swollen with possible fluid accumulation and inflammation; popping or crepitus; and decreased range of motion.
- iv. Diagnostic Testing Procedures: Rarely indicated.
- v. Non-Operative Treatment: Active and/or passive therapy, including ergonomic changes at work station(s), NSAIDs, therapeutic injections.
- vi. Surgical Indications: Suspected avulsion fracture, severe functional impairment unresponsive to conservative therapy.
- vii. Operative Treatment: Rarely indicated and only after extensive conservative therapy.
- viii. Post-Operative Therapy: Active and/or passive therapy.

10. BURSITIS:

- i. Description/Definition: Inflammation of bursa tissue. Can be precipitated by tendinitis, bone spurs, foreign bodies, gout, arthritis, muscle tears, or infection.
- ii. Mechanism of Injury: May be caused by sudden change in work habits, frequent repetitive motions in non-routine work profile, postural changes, contusion, frequent climbing, soft tissue trauma, fracture, continuous work on uneven surfaces, sustained compression force.
- iii. Specific Physical Findings: Palpable, tender and enlarged bursa, decreased range of motion, warmth. May have increased pain with range of motion.

- iv. Diagnostic Testing Procedures: Bursal fluid aspiration with testing for connective tissue, rheumatic disease, and infection. Radiographs, CT, MRI are rarely indicated.
- v. Non-Operative Treatment: Active and/or passive therapy, ice, therapeutic injection, treatment of an underlying infection, if present.
- vi. Surgical Indications: Bursa excision after failure of conservative therapy.
- vii. Operative Treatment: Surgical excision of the bursa.
- viii. Post-Operative Therapy: Active and/or passive therapy.

C. FOLLOW-UP DIAGNOSTIC IMAGING AND TESTING PROCEDURES

One diagnostic imaging procedure may provide the same or distinctive information as obtained by other procedures. Therefore, prudent choice of procedure(s) for a single diagnostic procedure, a complementary procedure in combination with other procedures(s), or a proper sequential order in multiple procedures will ensure maximum diagnostic accuracy; minimize adverse effect to patients and promote cost effectiveness by avoiding duplication or redundancy.

All diagnostic imaging procedures have a significant percentage of specificity and sensitivity for various diagnoses. None is specifically characteristic of a certain diagnosis. Clinical information obtained by history taking and physical examination should be the basis for selection and interpretation of imaging procedure results.

When a diagnostic procedure, in conjunction with clinical information, provides sufficient information to establish an accurate diagnosis, the second diagnostic procedure will become a redundant procedure. At the same time, a subsequent diagnostic procedure (that may be a repeat of the same procedure, when the rehabilitation physician, radiologist or surgeon documents the study was of inadequate quality to make a diagnosis) can be a complementary diagnostic procedure if the first or preceding procedures, in conjunction with clinical information, cannot provide an accurate diagnosis. Usually, preference of a procedure over others depends upon availability, a patient's tolerance, and/or the treating practitioner's familiarity with the procedure.

1. **IMAGING STUDIES:** When indicated, the following additional imaging studies can be utilized for further evaluation of the lower extremity, based upon the mechanism of injury, symptoms, and patient history. The studies below are listed in frequency of use, not importance.

a. **Magnetic Resonance Imaging (MRI):** provides a more definitive visualization of soft tissue structures, including ligaments, tendons, joint capsule, menisci and joint cartilage structures, than x-ray or Computed Axial Tomography in the evaluation of traumatic or degenerative injuries. The addition of intravenous or intra-articular contrast can enhance definition of selected pathologies.

In general, the high field, conventional, MRI provides better resolution. A lower field scan may be indicated when a patient cannot fit into a high field scanner or is too claustrophobic despite sedation. Inadequate resolution on the first scan may require a second MRI using a different technique. A subsequent diagnostic MRI may be a repeat of the same procedure, when the rehabilitation physician, radiologist or surgeon says the study was of inadequate quality to make a diagnosis. All questions in this regard should be discussed with the MRI center and/or radiologist.

Ferrous material/metallic objects present in the tissues is a contraindication for the performance of an MRI.

b. **Computed Axial Tomography (CT):** provides excellent visualization of bone and is used to further evaluate bony masses and suspected fractures not clearly identified on radiographic window evaluation. Instrument scatter-reduction software provides better resolution when metallic artifact is of concern. When ferrous/metallic materials are present in the tissues, CT should be ordered rather than MRI.

c. **Lineal Tomography:** Not recommended.

d. **Bone Scan (Radioisotope Bone Scanning):** ^{99m}Tc Technecium diphosphonate uptake reflects osteoblastic activity and may be useful in metastatic/primary bone tumors, stress fractures, osteomyelitis, and inflammatory lesions, but cannot distinguish among these entities.

It is useful for the investigation of trauma, infection, stress fracture, occult fracture, Charcot joint, Complex Regional Pain Syndrome, and suspected neoplastic conditions of the lower extremity.

- e. **Other Radionuclide Scanning:** Indium and gallium scans are procedures usually used to help diagnose lesions seen on other diagnostic imaging studies. ⁶⁷Gallium citrate scans are used to localize tumor, infection, and abscesses. ¹¹¹Indium-labeled leukocyte scanning is utilized for localization of infection or inflammation.
- f. **Arthrograms:** may be useful in the evaluation of internal derangement of a joint, only when MRI or other tests are contraindicated or not available. Potential complications of this more invasive technique include pain, infection, and allergic reaction
- g. **Diagnostic Arthroscopy:** Refer to Table 10

Table 10: Diagnostic Arthroscopy

PROCEDURE	CONSERVATIVE CARE	SUBJECTIVE	OBJECTIVE	IMAGING
DIAGNOSTIC ARTHROSCOPY	Medications OR Physical therapy	AND Pain and functional limitations continue despite conservative care	AND	Imaging is inconclusive

2. **OTHER TESTS:** The studies below are listed by frequency of use, not importance.

- a. **Electrodiagnostic Testing:** Electrodiagnostic testing for the knee includes, but is not limited to, Electromyography (EMG), Nerve Conduction Studies (NCS). Somatosensory Evoked Potentials (SSEP) is not recommended for conditions of the knee. Electrodiagnostic studies have limited use with knee disorders.
- b. **Doppler Ultrasonography/Plethysmography:** is useful in establishing the diagnosis of arterial and venous disease in the lower extremity and should be considered prior to the more invasive venogram or arteriogram study. Doppler is less sensitive in detecting deep-vein thrombosis in the calf muscle area. If the test is initially negative, an ultrasound should be repeated 7 days post initial symptoms to rule out popliteal thrombosis. It is also useful for

the diagnosis of popliteal mass when MRI is not available or contraindicated.

- c. **Venogram/Arteriogram:** is useful for investigation of vascular injuries or disease, including deep-venous thrombosis. Potential complications may include pain, allergic reaction, and deep-vein thrombosis.

D. THERAPEUTIC PROCEDURES, NON-OPERATIVE

Before initiation of any therapeutic procedure, the authorized treating provider, employer and insurer must consider these important issues in the care of the injured worker.

First, patients undergoing therapeutic procedure(s) should be released or returned to modified, restricted, or full duty during their rehabilitation at the earliest appropriate time.

Second, cessation and/or review of treatment modalities should be undertaken when no further significant subjective or objective improvement in the patient's condition is noted. If patients are not responding within the recommended duration periods, alternative treatment interventions, further diagnostic studies or consultations should be pursued.

Third, providers should provide and document education to the patient. No treatment plan is complete without addressing issues of individual and/or group patient education as a means of facilitating self-management of symptoms.

In unusual cases where a patient is unable to attend an outpatient center, home therapy may be necessary. Home therapy may include active and passive therapeutic procedures as well as other modalities to assist in alleviating pain, swelling, and abnormal muscle tone. Home therapy is usually of short duration.

The following procedures are listed in alphabetical order.

1. **ACUPUNCTURE:** is a procedure used for the relief of pain and inflammation and there is some scientific evidence to support its use. The exact mode of action is only partially understood. Western medicine studies suggest that acupuncture stimulates the nervous system at the level of the brain, promotes deep relaxation, and affects the release of neurotransmitters. Acupuncture is commonly used as an alternative or in addition to traditional Western pharmaceuticals. While it is commonly used when pain medication is reduced or not tolerated, it may be used as an adjunct to physical rehabilitation and/or surgical intervention to hasten the return of functional activity. Moxibustion and other complementary integrative medicine techniques are often combined with acupuncture, but

have no demonstrated efficacy. No additional reimbursement should be provided for acupuncture combined with moxibustion or other similar adjunctive procedures. Acupuncture must be performed by a professional who is authorized under the Workers' Compensation Laws and duly certified in New York State to provide acupuncture services.

a. **Acupuncture (With or Without Electrical Stimulation):** is the insertion and removal of filiform needles to stimulate acupoints (acupuncture points), with or without the use of electrical current (micro-amperage or milli-amperage) on the needles at the acupuncture site. Needles may be inserted, manipulated and retained for a period of time. Acupuncture can be used to reduce pain, reduce inflammation, increase blood flow, increase range of motion, decrease the side effect of medication-induced nausea, promote relaxation in an anxious patient, and reduce muscle spasm. Indications include joint pain, joint stiffness, soft tissue pain and inflammation, paresthesia, post-surgical pain relief, muscle spasm, and scar tissue pain.

- Time to produce effect: 3 to 6 treatments
- Frequency: 1 to 3 times per week
- Optimum duration: 1 month
- Maximum duration: 10 treatments.
- Total Time Frames for Acupuncture and Acupuncture with Electrical Stimulation: Time frames are not meant to be applied to each of the above sections separately. The time frames are to be applied to all acupuncture treatments regardless of the type or combination of therapies being provided.

2. **BIOFEEDBACK:** Not recommended.

3. **INJECTIONS-THERAPEUTIC:**

- i. Description: Therapeutic injections involve the delivery of anesthetic and/or anti-inflammatory medications to the painful structure. Therapeutic injections have many potential benefits. Ideally, a therapeutic injection will: (a) reduce inflammation in a specific target area; (b) relieve secondary muscle spasm; (c) allow a break from pain; and (d) support therapy directed to functional recovery. Diagnostic and therapeutic injections should be used early and selectively to establish a diagnosis and support rehabilitation. If injections

are overused or used outside the context of a monitored rehabilitation program, they may be of significantly less value.

- ii. **Contraindications:** General contraindications include local or systemic infection, bleeding disorders, allergy to medications used and patient refusal. Specific contraindications may apply to individual injections.

- a. **Soft tissue and Joint Injections** may be performed as analgesic or anti-inflammatory procedures. Injections into the tendon are not recommended.
 - Frequency: Not more than 2 to 3 times annually. Usually 1 or 2 injections adequate. A minimum of 3 weeks interval between injections is recommended.
 - Time to produce effect: Immediate with local anesthetic, or within 3 days with corticosteroids.
 - Optimum/maximum duration: Limited to 3 injections annually to the same site.
- b. **Trigger Point Injections:** Not recommended.
- c. **Prolotherapy (also known as sclerotherapy):** Not recommended.
- d. **Intra-Capsular Acid Salts (also known as viscosupplementation):** is a form of treatment for osteoarthritis or degenerative changes in the knee joint. It is recommended that these injections be considered a therapeutic alternative in patients who have failed non-pharmacological and analgesic treatment, and particularly, if non-steroidal anti-inflammatory drug treatment is contraindicated or surgery is not an option. The utility of viscosupplementation in severe osteoarthritis and its efficacy beyond 6 months is not well known.
 - Time to produce effect: One series of injections
 - Frequency: 1 series (as per product instructions)
 - Optimum/maximum duration: Varies. Efficacy beyond 6 months is not well known.

4. **MEDICATIONS:** Medication use in the treatment of knee injuries is appropriate for controlling acute pain and inflammation. Use of medications will vary widely due to the spectrum of injuries.

All drugs should be used according to patient needs. A thorough medication history, including use of alternative and over the counter medications, should be performed at the time of the initial visit and updated periodically. Treatment for pain control is initially accomplished with acetaminophen and/or NSAIDs. The patient should be educated regarding the interaction with prescription and over-the-counter medications as well as the contents of over-the-counter herbal products.

The following are listed in alphabetical order.

- a. **Acetaminophen:** is an effective analgesic with antipyretic but not anti-inflammatory activity. Acetaminophen is generally well tolerated, causes little or no gastrointestinal irritation, and is not associated with ulcer formation. Acetaminophen has been associated with liver toxicity in overdose situations or in chronic alcohol use. Patients may not realize that many over-the-counter preparations may contain acetaminophen. The total daily dose of acetaminophen is recommended not to exceed 4 grams per 24-hour period from all sources, including narcotic-acetaminophen combination preparations.
- Optimum Duration: 7 to 10 days.
 - Maximum Duration: Chronic use as indicated on a case-by-case basis.
- b. **Minor Tranquilizer/Muscle Relaxants:** Not recommended.
- c. **Narcotics:** Should be primarily reserved for the treatment of severe knee pain. In mild-to-moderate cases of knee pain, narcotic medication should be used cautiously on a case-by-case basis. Adverse effects include respiratory depression, the development of physical and psychological dependence, and impaired alertness. This medication has physically addictive properties and withdrawal symptoms may follow abrupt discontinuation.

Narcotic medications should be prescribed with strict time, quantity, and duration guidelines, and with definitive cessation parameters.

Pain is subjective in nature and should be evaluated using a scale to rate effectiveness of the narcotic prescribed. Any use beyond the maximum should be documented and justified based on the diagnosis and/or invasive procedures.

- Optimum Duration: 3 to 7 days.
- Maximum Duration: 2 weeks. Use beyond two weeks is acceptable in appropriate cases.

d. **Nonsteroidal Anti-Inflammatory Drugs (NSAIDs)**: are useful for pain and inflammation. In mild cases, they may be the only drugs required for analgesia. There are several classes of NSAIDs, and the response of the individual injured worker to a specific medication is unpredictable. For this reason, a range of NSAIDs may be tried in each case with the most effective preparation being continued. Patients should be closely monitored for adverse reactions. The US Food and Drug Administration advises that many NSAIDs may cause an increased risk of serious cardiovascular thrombotic events, myocardial infarction, and stroke, which can be fatal. Naproxen sodium does not appear to be associated with increased risk of vascular events. Administration of proton pump inhibitors, histamine 2 blockers, or prostaglandin analog misoprostol along with these NSAIDs may reduce the risk of duodenal and gastric ulceration but do not impact possible cardiovascular complications. Due to the cross-reactivity between aspirin and NSAIDs, NSAIDs should not be used in aspirin-sensitive patients, and should be used with caution in all asthma patients. NSAIDs are associated with abnormal renal function, including renal failure, as well as, abnormal liver function. Certain NSAIDs may have interactions with various other medications. Individuals may have adverse events not listed above. Intervals for metabolic screening are dependent upon the patient's age, general health status and should be within parameters listed for each specific medication. Complete Blood Count (CBC) and liver and renal function should be monitored at least every six months in patients on chronic NSAIDs and initially when indicated.

i. **Non-selective Nonsteroidal Anti-Inflammatory Drugs**:

Includes NSAIDs and acetylsalicylic acid (aspirin). Serious GI toxicity, such as bleeding, perforation, and ulceration can occur at any time, with or without warning symptoms in patients treated with traditional NSAIDs. Physicians should inform patients about the signs and/or symptoms of serious

gastrointestinal toxicity and what steps to take if they occur. Anaphylactoid reactions may occur in patients taking NSAIDs. NSAIDs may interfere with platelet function. Fluid retention and edema have been observed in some patients taking NSAIDs.

- Optimal duration: 1 week
- Maximum duration: 1 year

ii. Selective Cyclo-oxygenase-2 (COX-2) Inhibitors:-

Selective cyclo-oxygenase-2 (COX-2) inhibitors are more recent NSAIDs and differ in adverse side effect profiles from the traditional NSAIDs. The major advantages of selective COX-2 inhibitors over traditional NSAIDs are that they have less gastrointestinal toxicity and no platelet effects. COX-2 inhibitors can worsen renal function in patients with renal insufficiency, thus renal function may need monitoring.

COX-2 inhibitors should not be first-line for low risk patients who will be using an NSAID short term but are indicated in select patients for whom traditional NSAIDs are not tolerated. Serious upper GI adverse events can occur even in asymptomatic patients. Patients at high risk for GI bleed include those who use alcohol, smoke, are older than 65, take corticosteroids or anti-coagulants, or have a longer duration of therapy. Celecoxib is contraindicated in sulfonamide allergic patients.

Selective COX-2 inhibitors should be used with great caution in patients with ischemic heart disease and/or stroke and avoided in patients with risk factors for coronary heart disease. Patients with known cardiovascular disease or multiple risk factors for cardiovascular disease should have the risks and benefits of NSAID therapy for pain discussed. In these patients, it appears to be safest to use acetaminophen or aspirin as the first-line therapy. If needed, NSAIDs that are non-selective are preferred over COX-2 specific drugs. Patients who receive COX-2 inhibitors should take the lowest effective dose for the shortest time necessary to control symptoms. Even a relative lack of COX-2 selectivity does not completely eliminate the risk of cardiovascular events, and in that regard, all drugs in the NSAID spectrum should only be prescribed after thorough

consideration of risk/benefit balance. In patients receiving low-dose aspirin for primary or secondary cardiovascular disease prevention, to minimize the potential for the NSAID to counteract the beneficial effects of aspirin, aspirin should be taken at least 2 hours before or at least 8 hours after the NSAID.

- Optimal duration: 7 to 10 days
- Maximum duration: Chronic use is appropriate in individual cases.

f. **Tramadol:** is useful in relief of lower extremity pain and has been shown to provide pain relief equivalent to that of commonly prescribed NSAIDs. Although Tramadol may cause impaired alertness, it is generally well tolerated, does not cause gastrointestinal ulceration, or exacerbate hypertension or congestive heart failure. Tramadol should be used cautiously in patients who have a history of seizures or who are taking medication that may lower the seizure threshold, such as MAO inhibitors, SSRIs, and tricyclic antidepressants. This medication has physically addictive properties and withdrawal may follow abrupt discontinuation and is not recommended for patients with prior opioid addiction.

- Maximum duration: 2 weeks. Use beyond 2 weeks is acceptable in appropriate cases.

g. **Topical Drug Delivery** may be an alternative treatment of localized musculoskeletal disorders. It is necessary that all topical agents be used with strict instructions for application as well as maximum number of applications per day to obtain the desired benefit and avoid potential toxicity. As with all medications, patient selection must be rigorous to select those patients with the highest probability of compliance.

i. **Topical Salicylates and Nonsalicylates** have been shown to be effective in relieving pain in acute and chronic musculoskeletal conditions. Topical salicylates and nonsalicylates achieve tissue levels that are potentially therapeutic, at least with regard to COX inhibition. Other than local skin reactions, the side effects of therapy are minimal, although not nonexistent, and the usual contraindications to use of these compounds need to be considered. Local skin reactions are rare and systemic

effects even less common. Their use in patients receiving warfarin therapy may result in alterations in bleeding time. Overall, the low level of systemic absorption can be advantageous, allowing the topical use of these medications when systemic administration is relatively contraindicated such as is the case in patients with hypertension, cardiac failure, or renal insufficiency.

- Optimal duration: 1-2 weeks to determine effectiveness.
 - Continued use should be evaluated every 3 months.
- ii. Capsaicin is another medication option for topical drug use in lower extremity injury. Capsaicin offers a safe and effective alternative to systemic NSAID therapy. Although it is quite safe, effective use of capsaicin is limited by the local stinging or burning sensation that typically dissipates with regular use, usually after the first 7 to 10 days of treatment. Patients should be advised to apply the cream on the affected area with a plastic glove or cotton applicator and to avoid inadvertent contact with eyes and mucous membranes.
- Optimal duration: 1-2 weeks to determine effectiveness.
 - Continued use should be evaluated every 3 months.
- h. Glucosamine and Chondroitin dietary supplements may have potential in the treatment of degenerative joint conditions of the knee, but high quality, long term studies demonstrating objective improvement or side effects are lacking at this time. Long term effects of these dietary supplements are unknown.

5. ORTHOTICS AND PROSTHETICS

- a. Fabrication/Modification of Orthotics would be used when there is need to normalize weight-bearing, facilitate better motion response, stabilize a joint with insufficient muscle or proprioceptive/reflex competencies, to protect subacute conditions as needed during movement, and correct biomechanical problems.
- Time to produce effect: 1 to 3 sessions (includes wearing schedule evaluation).
 - Frequency: 1 to 2 times per week.

- Optimum/maximum duration: 4 sessions of evaluation, casting, fitting, and re-evaluation.
- b. **Orthotic/Prosthetic Training** is the skilled instruction (preferably by qualified providers) in the proper use of orthotic devices and/or prosthetic limbs including stump preparation, donning and doffing limbs, instruction in wearing schedule and orthotic/prosthetic maintenance training. Training can include gait, mobility, transfer and self-care techniques.
- Time to produce effect: 2 to 6 sessions.
 - Frequency: 3 times per week.
 - Optimum/maximum duration: 2 to 4 months.
- c. **Splints or Adaptive Equipment** design, fabrication and/or modification indications include the need to control neurological and orthopedic injuries for reduced stress during functional activities and modify tasks through instruction in the use of a device or physical modification of a device, which reduces stress on the injury. Equipment should improve safety and reduce risk of re-injury. This includes high and low technology assistive options such as workplace modifications, computer interface or seating, crutch or walker training, and self-care aids.
- Time to produce effect: Immediate.
 - Frequency: 1 to 3 sessions or as indicated to establish independent use.
 - Optimum/maximum duration: 1 to 3 sessions.
6. **PATIENT EDUCATION:** No treatment plan is complete without addressing issues of individual and/or group patient education as a means of prolonging the beneficial effects of treatment, as well as facilitating self-management of symptoms and injury prevention. The patient should be encouraged to take an active role in the establishment of functional outcome goals. They should be educated on their specific injury, assessment findings, and plan of treatment. Instruction on proper body mechanics and posture, positions to avoid, self-care for exacerbation of symptoms, and home exercise should also be addressed.
7. **RESTRICTION OF ACTIVITY:** Complete work cessation should be avoided, if possible, since it often further aggravates the pain presentation. Modified return-to-work is almost always more efficacious and rarely

contraindicated in the vast majority of injured workers with lower extremity injuries.

8. **RETURN-TO-WORK:** Communication is essential between the patient, employer and physician to determine appropriate restrictions and return-to-work dates. It is the responsibility of the physician to provide clear concise restrictions, and it the employer's responsibility to determine if temporary duties can be provided within the restrictions.
 - a. **Establishment of Activity Level Restrictions:** For lower extremity injuries, the following should be addressed when describing the patient's activity level:
 - i. Lower body postures such as squatting, kneeling, crawling, stooping, or climbing should include duration and frequency.
 - ii. Ambulatory level for distance, frequency and terrain should be specified.
 - iii. Standing duration and frequency with regard to balance issues.
 - iv. Use of adaptive devices or equipment for proper ergonomics to enhance capacities can be included.
 - b. **Compliance with Activity Restrictions:** In some cases, compliance with restriction of activity levels may require a complete jobsite evaluation, a functional capacity evaluation (FCE), or other special testing
9. **THERAPY-ACTIVE:** Most of the following active therapies have some evidence and are based on the philosophy that therapeutic exercise and/or activity are beneficial for restoring flexibility, strength, endurance, function, range of motion, and can alleviate discomfort. Active therapy requires an internal effort by the individual to complete a specific exercise or task. This form of therapy requires supervision from a therapist or medical provider such as verbal, visual and/or tactile instruction(s). At times, the provider may help stabilize the patient or guide the movement pattern but the energy required to complete the task is predominately executed by the patient.

Patients should be instructed to continue active therapies at home as an extension of the treatment process in order to maintain improvement levels. Home exercise can include exercise with or without mechanical assistance or resistance and functional activities with assistive devices.

The following active therapies are listed in alphabetical order.

- a. **Activities of Daily Living (ADL)** are instruction, active-assisted training and/or adaptation of activities or equipment to improve a person's capacity in normal daily activities such as self-care, work re-integration training, homemaking and driving.
 - Time to produce effect: 4 to 5 treatments.
 - Frequency: 2 to 3 times per week.
 - Optimum duration: 2 to 3 weeks.
 - Maximum duration: 3 weeks.

- b. **Functional Electrical Stimulation** is the application of electrical current to elicit involuntary or assisted contractions of atrophied and/or impaired muscles. Indications include muscle atrophy, weakness, and sluggish muscle contraction secondary to pain, injury, neuromuscular dysfunction or peripheral nerve lesion or where the potential for atrophy exists. May be an appropriate treatment in conjunction with an active exercise program.
 - Time to produce effect: 2 to 6 treatments.
 - Frequency: 3 times per week.
 - Optimum duration: 8 weeks.
 - Maximum duration: 8 weeks.

- c. **Gait Training** is crutch walking, cane or walker instruction to a person with lower extremity injury or surgery. Indications include the need to promote normal gait pattern with assistive devices; instruct in the safety and proper use of assistive devices; instruct in progressive use of more independent devices (i.e., platform-walker, to walker, to crutches, to cane); instruct in gait on uneven surfaces and steps (with and without railings) to reduce risk of fall, or loss of balance; and/or instruct in equipment to limit weight-bearing for the protection of a healing injury or surgery.
 - Time to produce effect: 3 to 4 treatments.
 - Frequency: 2 to 3 times per week.
 - Optimum duration: 2 weeks.

- Maximum duration: 2 weeks.
- d. **Neuromuscular Re-education**: Not recommended.
- e. **Therapeutic Exercise**: with or without mechanical assistance or resistance, may include isoinertial, isotonic, isometric and isokinetic types of exercises. Indications include the need for cardiovascular fitness, reduced edema, improved muscle strength, improved connective tissue strength and integrity, increased bone density, promotion of circulation to enhance soft tissue healing, improvement of muscle recruitment, increased range of motion and are used to promote normal movement patterns. Can also include complementary/ alternative exercise movement therapy.
- Time to produce effect: 2 to 6 treatments.
 - Frequency: 3 to 5 times per week.
 - Optimum duration: 4 to 8 weeks.
 - Maximum duration: 8 weeks.
- f. **Wheelchair Management and Propulsion** is the instruction and training of self-propulsion and proper use of a wheelchair. This includes transferring and safety instruction. This is indicated in individuals who are not able to ambulate due to bilateral lower extremity injuries, inability to use ambulatory assistive devices, and in cases of multiple traumas.
- Time to produce effect: 2 to 6 treatments.
 - Frequency: 2 to 3 times per week.
 - Optimum duration: 2 weeks.
 - Maximum duration: 2 weeks.
10. **THERAPY-PASSIVE** includes those treatment modalities that do not require energy expenditure on the part of the patient. They are principally effective during the early phases of treatment and are directed at controlling symptoms such as pain, inflammation and swelling. They should be use adjunctively with active therapies to help control swelling, pain and inflammation during the rehabilitation process. They may be used intermittently as deemed appropriate or regularly if there are specific goals with objectively measured functional improvements during treatment.

While protocols for specific diagnoses and post-surgical conditions may warrant durations of treatment beyond those listed as "maximum," factors such as exacerbation of symptoms, re-injury, interrupted continuity of care, and co-morbidities may extend durations of care. Having specific goals with objectively measured functional improvement during treatment can support extended durations of care. It is recommended that if after 3 to 5 visits no treatment effect is observed, alternative treatment interventions, further diagnostic studies or further consultations should be pursued.

The following passive therapies and modalities are listed in alphabetical order.

- a. **Continuous Passive Movement (CPM)** is a form of passive motion using specialized machinery that acts to move a joint and may also pump blood and edema fluid away from the joint and periarticular tissues. CPM is effective in preventing the development of joint stiffness if applied immediately following surgery. It should be continued until the swelling that limits motion of the joint no longer develops. Range of motion for the joint begins at the level of patient tolerance and is increased twice a day as tolerated. Use of this equipment may require home visits.
 - Time to produce effect: Immediate.
 - Frequency: Up to 4 times a day
 - Optimum duration: Up to 3 weeks post surgical.
 - Maximum duration: 3 weeks.
- b. **Contrast Baths:** Not recommended.
- c. **Electrical Stimulation (Unattended):** Not recommended. For the purposes of these guidelines, unattended means that the physician or therapist is not physically present with the patient on a 1:1 basis when treatment is being administered.
- d. **Fluidotherapy** employs a stream of dry, heated air that passes over the injured body part. The injured body part can be exercised during the application of dry heat. Indications include the need to enhance collagen extensibility before stretching, reduce muscle guarding, or reduce inflammatory response.
 - Time to produce effect: 1 to 4 treatments.

- Frequency: 1 to 3 times per week.
 - Optimum duration: 4 weeks.
 - Maximum duration: 1 month.
- e. **Infrared Therapy:** Not recommended.
- f. **Iontophoresis:** Not recommended.
- g. **Manipulation** is manual therapy that moves a joint beyond the physiologic range of motion but not beyond the anatomic range of motion. It is indicated for locked knee, contracture, or pain and loss of range of motion due to adhesions or contractures.
- Time to produce effect: Immediate or up to 10 treatments.
 - Frequency: 1 to 5 times per week as indicated by the severity of involvement and the desired effect.
 - Optimum duration: 10 treatments.
 - Maximum duration: 10 treatments.
- h. **Manual Electrical Stimulation** is used for peripheral nerve injuries or pain reduction that requires continuous application, supervision, or involves extensive teaching. Indications include muscle spasm (including TENS), atrophy, decreased circulation, osteogenic stimulation, inflammation, and the need to facilitate muscle hypertrophy, muscle strengthening, muscle responsiveness in Spinal Cord Injury/Brain Injury (SCI/BI), and peripheral neuropathies.
- Time to produce effect: Variable, depending upon use.
 - Frequency: 3 to 7 times per week.
 - Optimum duration: 8 weeks.
 - Maximum duration: 2 months.
- i. **Massage-Manual or Mechanical:** Not recommended.
- j. **Mobilization (Joint)** is passive movement, which may include passive range of motion performed in such a manner (particularly in relation to the speed of the movement) that it is, at all times, within

the ability of the patient to prevent the movement if they so choose. It may include skilled manual joint tissue stretching. Indications include the need to improve joint play, improve intracapsular arthrokinematics, or reduce pain associated with tissue impingement/maltraction.

- Time to produce effect: 6 to 9 treatments.
- Frequency: 3 times per week.
- Optimum duration: 10 treatments.
- Maximum duration: 10 treatments.

k. **Mobilization (Soft Tissue)** is the skilled application of manual techniques designed to normalize movement patterns through the reduction of soft tissue pain and restrictions. Indications include muscle spasm around a joint, trigger points, adhesions, and neural compression.

- Time to produce effect: 2 to 3 weeks.
- Frequency: 2 to 3 times per week.
- Optimum duration: 10 treatments.
- Maximum duration: 10 treatments.

l. **Paraffin Bath:** Not recommended.

m. **Superficial Heat and Cold Therapy:** Superficial heat and cold therapies are thermal agents applied in various manners that lower or raise the body tissue temperature for the reduction of pain, inflammation, and/or effusion resulting from injury or induced by exercise. It may be used acutely with compression and elevation. Indications include acute pain, edema and hemorrhage, need to increase pain threshold, reduce muscle spasm and promote stretching/flexibility. Includes portable cryotherapy units and application of heat just above the surface of the skin at acupuncture points. May be performed in conjunction with other active therapy, or may be self-administered by the patient.

- Time to produce effect: Immediate.
- Frequency: 2 to 5 times per week.

- Optimum duration: 3 weeks as primary, or up to 2 months if used intermittently as an adjunct to other therapeutic procedures.
 - Maximum duration: 2 months.
- n. **Short-wave Diathermy:** Not recommended.
- o. **Traction:** Not recommended.
- p. **Transcutaneous Electrical Nerve Stimulation (TENS):** treatment should include at least one instructional session for proper application and use. Indications include muscle spasm, atrophy and control of concomitant pain in the office setting. Minimal TENS unit parameters should include pulse rate, pulse width and amplitude modulation. Consistent, measurable, functional improvement must be documented and determination of the likelihood of chronicity prior to the provision of a home unit. TENS treatment should be used in conjunction with active physical therapy.
- Time to Produce Effect: Immediate.
 - Frequency: Variable.
 - Optimum Duration: 3 sessions.
 - Maximum Duration: 3 sessions. Purchase or provide with home unit if effective.
- q. **Ultrasound** uses sonic generators to deliver acoustic energy for therapeutic thermal effects. Indications include scar tissue, adhesions, contractures and muscle spasm, and the need to extend muscle tissue or accelerate the soft tissue healing.
- Time to produce effect: 6 to 15 treatments.
 - Frequency: 3 times per week.
 - Optimum duration: 4 to 8 weeks.
 - Maximum duration: 2 months.
- r. **Vasopneumatic Devices:** Not recommended.

- s. **Whirlpool** is conductive exposure to water at temperatures that best elicits the desired effect (cold vs. heat). It generally includes massage by water propelled by a turbine or Jacuzzi jet system and has the same thermal effects as hot packs if higher than tissue temperature. It has the same thermal effects as cold application if comparable temperature water used. Indications include the need for analgesia, relaxing muscle spasm, reducing joint stiffness, enhancing mechanical debridement and facilitating and preparing for exercise.
- Time to produce effect: 2 to 4 treatments.
 - Frequency: 3 to 5 times per week.
 - Optimum duration: 3 weeks as primary, or up to 2 months if used intermittently as an adjunct to other therapeutic procedures.
 - Maximum duration: 2 months.

E. THERAPEUTIC PROCEDURES — OPERATIVE

All operative interventions must be based upon positive correlation of clinical findings, clinical course and diagnostic tests. A comprehensive assimilation of these factors must lead to a specific diagnosis with positive identification of pathologic condition(s). It is imperative to rule out non-physiologic modifiers of pain presentation or non-operative conditions mimicking radiculopathy or instability (e.g., peripheral neuropathy, piriformis syndrome, myofascial pain, scleratogenous or sympathetically mediated pain syndromes, sacroiliac dysfunction, psychological conditions, etc.) prior to consideration of elective surgical intervention.

In addition, operative treatment is indicated when the natural history of surgically treated lesions is better than the natural history for non-operatively treated lesions. All patients being considered for surgical intervention should first undergo a comprehensive neuromusculoskeletal examination to identify mechanical pain generators that may respond to non-surgical techniques or may be refractory to surgical intervention.

Structured rehabilitation interventions should be strongly considered post-operative in any patient not making expected functional progress within three weeks post-operative.

1. **KNEE FUSION**

- i. Description/Definition: Surgical fusion of femur to tibia at the knee joint.
- ii. Diagnostic Testing Procedures: Radiographs, MRI, gallium scan (R/O infection). Lab work as indicated.
- iii. Non-Operative Treatment: Active and/or passive therapy for weight sharing braces, NSAIDs.
- iv. Surgical Indications: All reasonable conservative measures have been exhausted and other reasonable surgical options have been seriously considered or implemented.
- v. Operative Treatment: Usually open reduction, grafting, internal fixation. External fixation or intramedullary rodding may also be used.
- vi. Post-Operative Therapy: Active for protected weight-bearing and gait training.

2. TOTAL KNEE REPLACEMENT: Refer to Table 11

Table11: Knee Joint Replacement

PROCEDURE	CONSERVATIVE CARE	Clinical Findings		
		SUBJECTIVE	OBJECTIVE	IMAGING
<p>KNEE JOINT REPLACEMENT</p> <p>If only 1 compartment is affected, a unicompartmental or partial replacement if indicated</p> <p>If 2 of the 3 compartments are affected, a total joint replacement is indicated</p>	<p>Medications</p> <p>OR</p> <p>Viscosupplementation injections</p> <p>OR</p> <p>Steroid injection</p>	<p>AND</p> <p>Limited range of motion</p> <p>OR</p> <p>Night time joint pain</p> <p>OR</p> <p>No pain relief with conservative care</p>	<p>AND</p> <p>Over 50 years of age</p> <p>AND</p> <p>Body Mass Index of less than 35</p>	<p>AND</p> <p>Osteoarthritis on: Standing x-ray</p> <p>OR</p> <p>Arthroscopy</p>

3. AMPUTATION

- i. Description/Definition: Surgical removal of a portion of the lower extremity.
- ii. Mechanism of Injury: Usually secondary to post-traumatic bone, soft tissue, vascular or neurologic compromise of part of the extremity.
- iii. Specific Physical Findings: Non-useful or non-viable portion of the lower extremity.
- iv. Diagnostic Testing Procedures: Radiographs, vascular studies.
- v. Non-Operative Treatment: None.
- vi. Surgical Indications: Non-useful or non-viable portion of the extremity.

- vii. Operative Treatment: Amputation.
- viii. Post-Operative Therapy: Active and/or passive therapy for prosthetic fitting, construction and training, protected weight-bearing.

4. MANIPULATION UNDER ANESTHESIA

- i. Description/Definition: Passive range of motion of a joint under anesthesia.
- ii. Mechanism of Injury: Joint stiffness that usually results from a traumatic injury, compensation related surgery, or other treatment.
- iii. Specific Physical Findings: Joint stiffness in both active and passive modes.
- iv. Diagnostic Testing Procedures: Radiographs.
- v. Non-Operative Treatment: Active and/or passive therapy for active and passive range of motion exercises.
- vi. Surgical Indications: Is indicated in cases of intractable restriction and may be performed by a duly qualified surgeon. Consider if routine therapeutic modalities, including physical therapy and/or dynamic bracing, do not restore the degree of motion that should be expected after a reasonable period of time, usually at least 12 weeks.
- vii. Operative Treatment: Not applicable.
- viii. Post-Operative Therapy: Active and/or passive therapy for active and passive range of motion.

5. BURSECTOMY

- i. Description/Definition: Surgical removal of peri-articular bursa.
- ii. Mechanism of Injury: Usually a traumatic local injury or repetitive minor local irritation.
- iii. Specific Physical Findings: Swelling, tenderness over the bursa.
- iv. Diagnostic Testing Procedures: Radiographs.

- v. Non-Operative Treatment: Active and/or passive therapy for splinting, rest, NSAIDs, steroid injection.
- vi. Surgical Indications: Persistent pain, swelling despite treatment.
- vii. Operative Treatment: Surgical removal of the bursa.
- viii. Post-Operative Therapy: Active and/or passive therapy for graduated range of motion exercises.

6. **OSTEOTOMY**

- i. Description/Definition: A reconstructive procedure involving the surgical cutting of bone for realignment and is useful in patients that would benefit from realignment in lieu of total joint replacement.
- ii. Mechanism of Injury: Post-traumatic arthritis or deformity.
- iii. Specific Physical Findings: Painful decreased range of motion and/or deformity.
- iv. Diagnostic Testing Procedures: Radiographs, MRI scan, CT scan.
- v. Non-Operative Treatment: Active and/or passive therapy for activity modification, bracing, NSAIDs.
- vi. Surgical Indications: Failure of non-surgical treatment. Avoidance of total joint arthroplasty desirable.
- vii. Operative Treatment: Peri-articular opening or closing wedge of bone, usually with grafting and internal or external fixation.
- viii. Post-Operative Therapy: Active and/or passive therapy for protected weight-bearing, progressive range of motion.

7. **HARDWARE REMOVAL**

- i. Description/Definition: Surgical removal of internal or external fixation device.
- ii. Mechanism of Injury: Usually following healing of a post-traumatic injury that required fixation or reconstruction using instrumentation.

- iii. Specific Physical Findings: Local pain to palpation, swelling, erythema.
- iv. Diagnostic Testing Procedures: Radiographs, tomography, CT scan, MRI.
- v. Non-Operative Treatment: Active and/or passive therapy for local modalities, activity modification. NSAIDs.
- vi. Surgical Indications: Persistent local pain, irritation around hardware.
- vii. Operative Treatment: Removal of instrumentation. Some instrumentation may be removed in the course of standard treatment without local irritation.
- viii. Post-Operative Therapy: Active and/or passive therapy for progressive weight-bearing, range of motion.

8. RELEASE OF CONTRACTURE

- i. Description/Definition: Surgical incision or lengthening of contracted tendon or peri-articular soft tissue.
- ii. Mechanism of Injury: Usually following a post-traumatic injury.
- iii. Specific Physical Findings: Shortened tendon or stiff joint.
- iv. Diagnostic Testing Procedures: Radiographs, CT scan, MRI scan.
- v. Non-Operative Treatment: Active and/or passive therapy for stretching, range of motion exercises.
- vi. Surgical Indications: Persistent shortening or stiffness associated with pain and/or altered function.
- vii. Operative Treatment: Surgical incision or lengthening of involved soft tissue.
- viii. Post-Operative Therapy: Active and/or passive therapy for stretching, range of motion exercises.

APPENDIX

Sources:

This Treatment Guideline is adopted, with modification, from the State of Colorado's Lower Extremity Medical Treatment Guideline, with supplementation from ACOEM's¹ Occupational Medicine Treatment Guidelines and the State of Washington's Medical and Surgical Treatment Guidelines.

¹ American College of Occupational and Environmental Medicine.

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