

Foot Capsule Disorders

"Midtarsal Joint Capsulitis"

ICD-9-CM: 845.11 Sprain of tarsometatarsal joint

Diagnostic Criteria

History: Arch area pain - medial or lateral
Pain worse with single limb support phase of gait
Recent strain or repetitive use

Physical Exam: Pain at end range of one or more of the following accessory movement tests (dorsal glide or plantar glide of the distal bone on a stabilized proximal bone):

Medial Foot

Talus - Navicular

Navicular - 1st Cuneiform

Lateral Foot

Calcaneus – Cuboid

Navicular/3rd Cuneiform – Cuboid



Talus - Navicular Accessory Movement Test

Cues: Patient sits on edge of table to allow knee flexion
Proximal forearm rests on tibia, index finger metacarpal (MCP) stabilizes dorsal surface of talus, PIP and DIP stabilize talus using sustentaculum tali of calcaneus
Distal index finger MCP provides the planter glide and PIP and DIP provide the dorsal glide of the navicular
Alter forearm/upper extremity angle to align force with the "treatment plane" (move the navicular with a glide parallel to the plane of the talonavicular joint)
Determine symptom response, available motion, and end feel



Navicular - 1st Cuneiform Accessory Movement Test

Cues: Proximal MCP, PIP, and DIP stabilize navicular
 Distal MCP, PIP, and DIP move 1st cuneiform
 Determine symptom response, available motion, and end feel



Calcaneus - Cuboid Accessory Movement Test

Cues: Calcaneus rests on stabilizing hand which rests on table, outside hand grabs cuboid
 Thumb on plantar surface, index and/or middle finger on dorsal surface of cuboid
 "Up and out, down and in" - using a straight plane, translatory force (in line with the "treatment plane")
 Determine symptom response, available motion, and end feel



Navicular/3rd Cuneiform - Cuboid Accessory Movement Test

Cues: Inside hand now stabilizes navicular and 3rd cuneiform (Thumb on plantar surface, index and middle finger on dorsal surface)
Move cuboid "up and out, down and in"

"Hallux Rigidus"

ICD-9-CM: 735.1 Hallux rigidus

Diagnostic Criteria

History: Stiffness
Pain with barefoot walking - symptoms worse at pre-swing ("toe-off")

Physical Exam: Limited motion of 1st metatarsophalangeal (MTP) extension
Pain at end range of extension ROM
Limited MTP accessory movements - especially volar glide



1st MTP Extension ROM

Cues: Depress 1st metatarsal plantarly, extend proximal phalanx of big toe dorsally
Measure angle of metatarsal shaft to proximal phalanx.
Normal ROM is 65 degrees



1st MTP Accessory Movement Test
Dorsal Glide of Proximal Phalanx

Cues: Loose pack position is 10 degrees of dorsiflexion
"Bunch Skin"
Glide parallel to articulating surface of the proximal phalanx
Compare with opposite side for normal amount of movement (if the opposite side has normal range of motion)
Determine symptom response at end range

Hallux Rigidus

ICD-9: 735.1

Description: Hallux rigidus is considered a progressive disorder of the 1st MTP joint marked by pain, decreased dorsiflexion, and degenerative changes in the joint.

Etiology: Hallux rigidus can be caused by osteoarthritis, repetitive trauma, or anatomic abnormalities of the foot. Patients with hallux rigidus present with complaints of pain localized at the first MTP joint and/or joint stiffness. These symptoms can be insidious or as the result of an injury. The pain associated with this condition is often noted with increased activities that require a patient to extend the first MTP joint as in squatting, jumping, kicking, and dancing. Another cause of symptoms is shoes that irritate the soft tissues at the subcutaneous bony prominences and shoes such as high-heels that require extended amounts of time in MTP extension and MTP jamming. According to the Clinical Practice Guideline First Metatarsophalangeal Joint Disorders Panel, “the hallmark of hallux rigidus is the typical dorsal bunion caused by both the proliferative disease and the flexion at the first MTP joint. This position of hallux equinus results in retrograde elevation of the metatarsal and the uncovering of the dorsal portion of the articulation. Dorsiflexion is generally limited because of abutment of the articular surfaces of the phalanx and metatarsal head, and motion is painful with/without crepitus.” The patient will generally walk with an antalgic gait, which can lead to problems in other joints of the foot. Radiographic findings are consistent with those of osteoarthritis. The division of hallux rigidus into stages is based on the progression of osteoarthritis. A patient with stage I may present with little or no radiographic joint changes and a patient with stage IV will demonstrate severe end-stage arthrosis. The majority of the medical literature acknowledges these 4 stages; however, Magee divides hallux rigidus into two categories: acute and chronic. The following lists describe the signs and symptoms associated with both the stage divisions and the acute/chronic divisions.

The stages are taken from *J Foot Ankle Surg.* 42(3):124-36. 2003.

Stage I: Stage of Functional Limitus

- Hallux equinus/flexus
- Plantar subluxation proximal phalanx
- Metatarsus primus elevatus
- Joint dorsiflexion may be normal with nonweightbearing, but ground reactive forces elevate the first metatarsal and yield limitation
- No degenerative joint changes noted radiographically
- Hyperextension of the hallucal interphalangeal joint
- Pronatory architecture

Stage II: Stage of Joint Adaptation

- Flattening of the first metatarsal head
- Osteochondral defect/lesion
- Cartilage fibrillation and erosion
- Pain on end ROM
- Passive ROM may be limited
- Small dorsal exostosis

- Subchondral eburnation
- Periarticular lipping of the proximal phalanx, the first metatarsal head, and the individual sesamoids

Stage III: Stage of Established Arthrosis

- Severe flattening of the first metatarsal head
- Osteophytosis, particularly dorsally
- Asymmetric narrowing of the joint space
- Degeneration of articular cartilage
- Erosions, excoriations
- Crepitus
- Subchondral cysts
- Pain on full ROM
- Associated inflammatory joint flares

Stage IV: Stage of Ankylosis

- Obliteration of joint space
- Exuberant osteophytosis with loose bodies within the joint space or capsule
- $<10^\circ$ ROM
- Deformity and/or misalignment
- Total ankylosis may occur
- Inflammatory joint flares possible
- Local pain is most likely secondary to skin irritation or bursitis caused by the underlying osteophytosis

The following classification is taken from: Magee DJ. *Orthopedic Physical Assessment*:

Acute (adolescent)

- Primarily in young people with long, narrow, pronated feet
- Boys > girls
- Constant, burning, throbbing, or aching pain and stiffness come on quickly
- Palpable tenderness over MTP joint
- 1st metatarsal head may be elevated, large, and tender
- Antalgic gait

Chronic

- Primarily in adults
- Men > women
- Frequently bilateral
- Usually result of repeated minor trauma leading to osteoarthritic changes
- Stiffness gradually develops and the pain persists

Intervention Approaches / Strategies

If the patient chooses to first attempt conservative/non-surgical treatment it is essentially the same for stages I-IV (along with acute and chronic). This is an inflammatory joint disorder so the most important thing is to reduce inflammation and not aggravate the condition.

Stage I-IV (non-surgical)

Goals: 1) decrease inflammation and pain

2) restore ROM

3) if conservative treatment does not work, but patient is unwilling to have surgery it is important to teach patient how to manage pain and function with decreased 1st MTP motion

- Physical Agents: phonophoresis/iontophoresis, US, NSAIDS, steroid injection, grade I-II joint mobs for pain relief, rest, ice, whirlpool, HVGC
- External Devices: Orthoses, shoe modifications to limit extension at 1st MTP
- Therapeutic Exercises: painfree AROM or passive ROM exercises
- Re-Injury Prevention Instruction: Temporarily cease/reduce aggravating activities.

When conservative treatment does not reduce the impairments and the patient is not willing to live with hallux rigidus there are several surgical options. If the patient is in stage I or II they are usually good candidates for joint-salvage procedures. These include cheilectomy, metatarsal astronomy, phalangeal osteotomy, and chondroplasty. If the joint has progressed to stage III or IV often a joint destructive procedure is appropriate. These include resection arthroplasty, implant arthroplasty, and arthrodesis. The two procedures that are utilized most often are cheilectomy and arthrodesis. While individual surgeons have slightly different protocol for post-surgical treatment, there are general guidelines that most surgeons request.

Post-Surgical Management – Guidelines taken from *J Bone Joint Surg.* 85A(11):2072-87.2003.

Cheilectomy: Passive ROM exercises are begun within 10 days post-operatively. Aggressive stretching is allowed as pain and swelling subside. Weight bearing as tolerated is allowed following surgery with the patient wearing a stiff-soled postoperative shoe. Final stages of rehab include teaching the patient a normal, functional gait pattern.

Arthrodesis of the 1st MTP Joint: The foot is placed in a stiff-soled postoperative shoe after surgery, and weight-bearing on the heel and the lateral aspect of the involved foot is permitted. The first ray remains unweighted until there is radiographic evidence of a fusion.

Selected References

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Posterior Medial Calf



Posterior Lateral Calf

Impairment: Limited Ankle Dorsiflexion
Limited Inferior Tibiofibular Accessory Movements



Fibular Posterior Glide

Cues: Stabilize the tibia by 1) resting in on the treatment table, and 2) using the thenar eminence of one hand to stabilize the medial malleolus
Slightly internally rotate the tibia (to line up the treatment plane perpendicular to gravity)
Posteriorly glide the fibula using the thenar eminence of the other hand (“catch” the skin on the anterior aspect of the ankle to provide a firmer grip on the fibular)



Fibular Anterior Glide

Cues: Position the patient prone with feet of the edge off the table - but keep the distal tibia on the table
Stabilize the tibia with one hand - internally rotate it a bit
Glide the fibula anteriorly

The following reference provides additional information regarding this procedure:
Freddy Kaltenborn PT: Manual Mobilization of the Extremity Joints, p. 158, 1989

Impairment: Limited Ankle Dorsiflexion
Limited Talar Posterior Glide



Talar Posterior Glide

Cues: Stabilize tibia with one hand - cushion the Achilles tendon with your fingers
between the tendon and the table
Contact the talus with a “V” formed between your thumb and your index finger
metacarpal head
Posteriorly glide the talus using a weight shift from the lateral side of the table

The following reference provides additional information regarding this procedure:
Freddy Kaltenborn PT: Manual Mobilization of the Extremity Joints, p. 154, 1989

Impairment: Limited Ankle Dorsiflexion
Limited Talar Posterior Glide



Talar Posterior Glide MWM

Cues: Stand facing the patient
Place a towel pad between the Achilles tendon and the table
Grasp the calcaneus with the palm of one hand and the talus with the web space of the other hand
Elicit active dorsiflexion
Maintain the dorsiflexion with pressure from your abdomen
“Relax” the dorsiflexors
Glide the talus and calcaneus posteriorly - using a slight knee bent
Maintain the posterior glide of the calcaneus and again elicit active dorsiflexion – take up the slack with your abdomen
Repeat the posterior glide of the talus and calcaneus
Again, “relax” the dorsiflexors
Repeat the sequence several times

The following reference provides additional information regarding this procedure:
Brian Mulligan MNZSP, DipMT: Manual Therapy, p. 96-97, 1995

Impairment: Limited and Painful Talocrural Dorsiflexion



Ankle Dorsiflexion MWM

Cues: Position the patient standing on a secure treatment table with the patient using a wide base of support and another person or a stationary object for balance assist

Using a belt, glide the tibia and fibula anteriorly

Match the anterior glide with an equal and opposite posteriorly glide on the talus using a dummy thumb and thenar eminence

If the opposing forces are balanced the patient remains stable

Attempt to keep the midtarsal joint in the supinated position

Sustain both glides and midtarsal supination while the patient actively dorsiflexes (by shifting weight forward and bending the involved knee)

The following reference provides additional information regarding this procedure:

Brian Mulligan MNZSP, DipMT: Manual Therapy, p. 96-98, 1995

Impairment: Limited and Painful Talocrural Plantarflexion



Ankle Plantarflexion MWM

Cues: Position patient supine with a partially flexed knee
Glide the tibia and fibula posteriorly with one hand
Grasp the talus with the web space of your other hand
Sustaining the posterior glide, “roll” the talus anteriorly as the foot is actively
and/or passively plantar flexed

The following reference provides additional information regarding this procedure:
Brian Mulligan MNZSP, DipMT: Manual Therapy, p. 95-96, 1995

Impairment: Limited Ankle Plantarflexion
Limited Talar Anterior Glide



Talar Anterior Glide

Cues: Stabilize the tibia with one hand - use your fingers as a pad between the anterior tibia and the table
Glide the calcaneus (and, thus, also the talus) anteriorly using a weight shift from the lateral side of the involved ankle

The following reference provides additional information regarding this procedure:
Freddy Kaltenborn PT: Manual Mobilization of the Extremity Joints, p. 155, 1989

Impairment: Limited Subtalar Eversion
Limited Calcaneal Lateral Glide



Calcaneal Lateral Glide

Cues: Position the patient lying on the involved side with the involved heel off the side of the treatment table

Stabilize and pad the lateral malleolus against the table with one hand

Mobilize either 1) the posterior talocalcaneal, or 2) the anterior talocalcaneal joint(s) with the thenar eminence of the other hand - use a weight shift from the end of the table

The procedure is contrary to convex - concave principles but the consensus of the “foot nerds” of Southern California (including myself) is the lateral glides work best for restoring calcaneal eversion (probably because the talocalcaneal joint surfaces are more planar than spheroid)

Impairment: Limited Navicular Plantar Glide
(at the talonavicular joint)



Navicular Plantar Glide

Cues: Flex the knee and stabilize the calcaneus and, thus, also the talus, on a wedge
Slightly internally rotating the limb and placing a finger under the medial side of the talus provides additional stabilization
Contact the navicular with the index finger metacarpal head and mobilize the navicular plantarly
Be sure that your mobilization is parallel to the treatment plane
Modifications of this procedure can be used for any of the tarsal plantar glide mobilizations (i.e., stabilize the dorsal surface of the proximal bone on a wedge and mobilize the distal bone plantarly)

The following reference provides additional information regarding this procedure:
Freddy Kaltenborn PT: Manual Mobilization of the Extremity Joints, p. 148, 1989

Impairment: Limited Cuboid Dorsal Glide
(at the calcaneocuboid joint)



Cuboid Dorsal Glide

Cues: Position the patient prone with the dorsal lateral surface of the calcaneus on the wedge
Slight internal rotation of the tibia provide additional calcaneal stabilization
Contact the cuboid with either 1) the head of the index finger metacarpal, or 2) a “dummy” thumb under the mobilizing thenar eminence

The following reference provides additional information regarding this procedure:
Freddy Kaltenborn PT: Manual Mobilization of the Extremities