CAOM Foot and Ankle Review

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Anatomy and Biomechanics

- *Hindfoot*
    - Subtalar joint – allows for pronation and supination. The anterior and posterior joint spaces are separated by the sinus tarsi, the anterior joint space acting as a ball in socket joint, but both sharing a similar rotational axis. Support provided by deep and peripheral ligaments and retinaculae. The subtalar converts tibial torsion to pronation and supination.
    - Tibiotalar joint – Uniplanar hinge joint with some mild coronal plane rotation.
    - Achilles tendon posteriorly – Proximally becomes the gastrocsoleus muscles.

- *Midfoot*
    - This is the location of LisFranc's injuries characterized by minimal movement in the tarsometatarsal joints due to strong intermetatarsal and intertarsal ligaments. Plantar LisFranc's ligament runs from the medial cuneiform to the 2nd metatarsal. The talonavicular joint acts as a ball and socket joint with an axis through the talar neck. The calcaneocuboid joint is a saddle joint. Both lock during mid stance phase to promote transmission of force/propulsion.

- *Forefoot*
    - Metatarsophalangeal joints - Highly specialized joints to allow for toe off. Strong collateral ligaments are required for the first MTPJ.

- *Arches of the foot*
    - Medial and lateral longitudinal arches. Medially the talus forms a wedge with the navicular and calcaneus providing static stability. The most important stabilizer of the longitudinal arches is the plantar fascia, then the long and short plantar ligaments, then the spring ligament.

- *Phases of gait*
    - 60% stance, 40% swing. More simply described as heel strike with pronation into toe off, it encompasses 3 stages of a rocker mechanism of stance. The metatarsophalangeal joint dorsiflexion engages the "Windlass effect" tensioning the plantar fascia transforming the foot into a rigid lever transmitting force from the gastrocsoleus muscles through the Achilles tendon across the plantar fascia to the forefoot.

- *Lateral ankle stability*
    - ATFL (Attachments at the lateral malleoli to anterolateral talus at a 45 degree orientation), resists inversion and taught when plantarflexed, tibial external rotation, and anterior drawer movement.
    - CFL, the second strongest ligament of the ankle originating from the inferior fibula to the lateral calcaneus. Resists inversion and taught in dorsiflexion, lax in plantarflexion.
    - PTFL, short structure from the distal posterolateral fibula to the talus.

- *Medial ankle stability*
    - Deltoid ligament, the strongest ankle ligament has superficial and deep fibers, divided into 3 slips each respectively. Superficially originating from the anteroinferior medial malleoli to the navicular, calcanealnavicular ligament, sustentaculum tali, and then the tuberosity of the calcaneus. The deep fibers attach deep onto the non-articular surface of the medial talus.

Injury Patterns

- *Inversion sprain* – Most common injury, often in field athletes involving the lateral ankle ligaments and potentially peroneal muscle tendons.
- *Eversion sprain* – Forced eversion mechanism involving the deltoid ligament and potentially the tibialis anterior tendon.
- *High ankle sprain* – Involving the AITFL and potentially syndesmosis, often involves hyperdorsiflexion and external rotational.
- *Plantar fasciopathy* – Chronic repetitive overuse, often seen in runners.
- *Achilles tendinopathy* – Traumatic, overload, repetitive overuse.
- *Pes planus* – Commonly congenital and associated with hypermobility.
- *Hindfoot pain* – Achilles, plantar fascia structures and subtalar joint, overuse injuries.
- *Midfoot pain* – DDx: LisFranc injury (Midfoot pain >5 days), ligamentous injury, medial plantar nerve pain.
- *Forefoot pain* – Consider osteoarthritis, Turf Toe (Sprain of first MTPJ with hyperextension), joint laxity, or potential neuroma.

Examination

- *Ottawa Ankle Rules* – Xray if bony tenderness at distal 6cm of the medial or lateral malleoli, or inability to weight bear (4 steps).
- *Ottawa Foot Rules* – Xray if pain at base of 5^{th} metatarsal, navicular, or inability to weight bear.
- *Radiographs* – AP, Lat, Mortis, for LisFranc injury order weight bearing films of the foot.
- *Observation*

    - Swelling/Bruising/Asymmetry/Deformity.
    - Shoe inspection for asymmetric wear pattern.
    - Hindfoot Valgus/Varus - ?Correctable with heel raise, consider subtalar joint.
    - Too Many Toes Sign
- *Palpation*
    - All bony prominence including talar dome where accessible to assess for talar dome lesions/fracture and medial calcaneal tuberosity for plantar fasciopathy.
    - LisFranc – Most commonly injured are first metatarsal/second metatarsal/medial and intermediate cuneiform.
    - Sinus tarsi pain to palpation.
    - Motion palpation of the subtalar joint and mortis joint.
    - Sesamoid bones
- *AROM/PROM/RROM* (muscular injuries) in cardinal movements.
- *Neurovascular screening*
    - Posterior tibial artery, dorsal pedis artery, capillary refill.
    - Medial plantar nerve for medial arch pain – Tinel's, Adductor hallucis muscle test.
    - Tarsal Tunnel - Tinel's over tarsal tunnel or sensory abnormality over medial arch.
- *Special tests*
    - Lunge test (Anterior impingement).
    - Anterior drawer test (ATFL/CFL)
    - (Lateral) Talar tilt (ATFL/CFL)
    - Squeeze test (Syndesmostic/AITFL injury)
    - External rotation test (Syndesmotic injury)
    - Impingement testing (Anterior/Posterior)
    - Thompson's test (Achilles rupture)
    - Instability of MTPJs (Superior/inferior joint play)
    - Morton's Foot Squeeze (Interdigital neuroma)
    - Forced passive inversion/eversion of subtalar joint (Subtalar joint)
        - Video

Management options

- *Conservative Care* – Physiotherapy, Manual therapy, Orthotics, Bracing, Boot.
- *Investigations* - Nerve conduction studies for tarsal tunnel syndrome. Ultrasound for suspected tendinopathy or plantar fasciitis or neuroma. Bonescan or CT for suspected stress fracture or talar dome fracture or osteochondral defect.
- *Surgical Indications* – Fracture or failure of 12 weeks of appropriate rehabilitation.
- *Regenerative injection* sites based on suspected pathology
    - Inversion sprain – ATFL, CFL, Pericuboid and Bifurcate ligaments, Subtalar joint, Peroneal tendons.
    - Eversion sprain – Deltoid ligament, Subtalar joint, Tibialis anterior tendon.
    - High ankle sprain – AITFL, Syndesmosis, ATFL, CFL, Subtalar joint.

- Plantar fasciopathy – Plantar fascia origin, Subtalar joint, Long and short plantar ligaments, Spring ligament.
- Achilles tendinopathy – Achilles tendon – insertion and midsubstance.
- Pes planus – Medial arch structures.
- Midfoot pain – Talonavicular joint, perinavicular, pericuboid, and Spring ligament, long and short plantar ligaments.
- Forefoot pain - Joint capsules and collateral ligaments of the phalangeal joints.

Marking for Landmark Guided Injections

See Regenerative Injections: The Art of Healing 7th ed. J. Baumgartner. 2017.

US Guided Injections

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References

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