Anatomy:
The foot and ankle is designed to provide stability and mobility of the distal lower extremity. The foot and ankle bones consist of (distal tibia and fibula, 7 tarsal, 5 metatarsals, and 14 phalanges). The bones of the foot form many joints which are connected via many different ligaments. Ligaments are strong elastic bands of connective tissue that connect bone to bone. The outside of the ankle is stabilized by the anterior talofibular, calcanofibular, posterior talofibular, and talocalcaneal ligaments and the tendons of the peroneal longus and peroneal brevis muscles. Stability of the medial ankle is provided by the deltoid ligament and the tendons of the posterior tibialis, flexor digitorum longus, and flexor hallucis muscles. The foot and ankle consists of several joints indicated on the picture:

- **Talocrural Joint** (Ankle Joint) - This joint allows for plantarflexion (toes up) and dorsiflexion (toes down). Normal range of motion (ROM) of plantarflexion is 50 degrees and normal ROM dorsiflexion is 20 degrees.
- **Subtalar /Talocalcaneal Joint** - The Subtalar joint allows for inversion (heel in) and eversion (heel out) of the foot. This joint allows for accommodation to uneven surfaces with walking. Normal ROM for inversion is 35 degrees and eversion 15 degrees.
- **Talonavicualar Joint** - This joint allows for a great amount of mobility of the foot such as the triplanar motions of supination and pronation. Supination consists of plantarflexion, adduction, and inversion. Pronation consists of dorsiflexion, abduction, and eversion.
- **Calcaneocuboid Joint** - This joint has limited mobility but does contribute to pronation, supination, eversion, and inversion.

The foot also consists of three arches (medial, longitudinal, and transverse), which help to absorb shock and store mechanical energy. It is important to strengthen the arch of the foot to provide a foundation for weight bearing activities.

Causes/Mechanism of Injury:
Hypomobility of the foot and ankle leads to a rigid foot and is characterized by decreased range of motion due to tight ligaments. Hypomobility also leads to decreased shock absorbing capacity and increases pain during weight bearing activities such as prolonged walking and running.

Hypomobility of the foot/ankle can be caused due to pathologies such as rheumatoid arthritis, juvenile rheumatoid arthritis, degenerative joint disease, and acute joint reactions following trauma. Post-trauma injuries such as dislocations and fractures that require splint or cast immobilization are at risk for post-immobilization contractures and adhesions within the soft-tissue and joint capsule. Degenerative joint disease (DJD) and post-immobilization stiffness affects only the specific joint or joints involved, however, rheumatoid arthritis is progressive and can lead to rupture of the tendons in the foot/ankle complex also possible deformities of the foot.
Symptoms:
Foot/ankle hypomobility can produce many functional limitations and disabilities as a result of decreased weight-bearing. Acute symptoms include increased swelling and restricted, painful motion. Chronic hypomobility symptoms include restricted joint motion, decreased joint play, and a firm capsular end- feel within the affected joint. Limited or restricted motions are determined by which joint becomes hypomobile. Hypomobility can affect the following joints and limit the respective motions at each joint:

- **Proximal and distal tibiofibular joint**- limits ankle and subtalar joint motion, supination with inversion (heel in) and pronation with eversion (heel out).
- **Talocrural joint**- plantarflexion (toes down) is limited more than dorsiflexion (toes up)
- **Subtalar and transverse tarsal joints**- progressive limitation of supination leads to fixed pronation and flattening of medial longitudinal arch
- **MTP joint of great toe**- gross limitation of extension and small limitation of flexion

Hypomobility can also lead to deformities of the foot, muscle weakness and decreased muscular endurance, impaired balance and postural control, increased risk of falling, decreased ambulation, gait deviations characterized by shot stance phase, decreased single leg phase, and decreased stride length on involved side.

Treatment/Management:
Interventions selected to manage hypomobility should be determined based on the present symptoms. Emphasis should be placed on patient education including the importance of daily range of motion (ROM) and stretching exercises, endurance activities, and joint protection strategies including faulty foot and ankle postures, and proper shoe-wear education to avoid deforming weight bearing forces. Rehabilitation should focus on decreasing pain. Manual therapy techniques Grade I – IV distraction and oscillation techniques may help increase nutrition by moving the synovial fluid within the involved joint. Also, orthotic devices and proper shoe wear can decrease pain and improve mobility by realigning forces throughout the foot and providing greater support of the foot and ankle. Passive, active assistive, and active range of motion exercises are crucial to increase motion. Patients should also be examined for muscle weakness and balance impairments. Exercises should be patient specific and appropriate for the patient’s condition. Exercises should focus on reducing joint restriction, increasing ROM, muscular flexibility, and strength.

**Joint Mobilizations:**
- **Proximal and distal tibiofibular joint**- limits ankle and subtalar joint motion, supination with inversion (heel in) and pronation with eversion (heel out).
- **Talocrural joint**- plantarflexion (toes down) is limited more than dorsiflexion (toes up)
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**Exercises/post op protocol:**
**Phase 1:**
- Stretching
- Passive Range of motion

**Phase 2:**
- Begin active range of motion
- Strength training
- Balance

**Phase 3:**
- Progress strength program
- Progress Balance training
- Begin walking/running (patient specific)